

CONSULTATIVE GROUP ON INTERNATIONAL AGRICULTURAL RESEARCH
TECHNICAL ADVISORY COMMITTEE AND CGIAR SECRETARIAT

Sixty-Sixth Meeting, CIP Hqs., Lima (Peru), 13-24 March 1995

REPORT OF THE
FOURTH EXTERNAL PROGRAMME AND MANAGEMENT REVIEW
OF THE
CENTRO INTERNACIONAL DE AGRICULTURA TROPICAL
(CIAT)

(Agenda Item 5)

TAC SECRETARIAT
FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

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FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS**

February 1995

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13 February 1995

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Dear Dr. Winkelmann and Mr. von der Osten,

I have pleasure in transmitting to you the Report of the Fourth External Programme and Management Review of the International Centre for Tropical Agriculture (CIAT). The Panel charged with the Review has closely examined the Centre's activities at its Headquarters at Cali, Colombia. Panel members and consultants have also visited a cross-section of the countries where CIAT conducts operations jointly with national systems and other centres.

As you will see from our report, CIAT has faced a daunting series of problems in the last three years. Despite funding setbacks and a leadership crisis, it has almost completed the transition to a centre with natural resources management as a major part of its research agenda. The process has been a painful one in many ways, but we believe it has been broadly successful. We have proposed a number of improvements in recently introduced measures, but we have no reservations about the general thrust of the changes that have been made.

The Centre has been through a massive down-sizing, of which the main brunt fell on local staff. We have been deeply impressed by the way in which this was carried

through in a humane manner, without creating labour disturbances, and without leaving a legacy of bitterness.

CIAT's greatest need right now is for a period of stability under inspiring leadership from a new Director-General. I would like to pay tribute to the way in which Robert Havener has restored morale over the last few months as Interim Director-General, and this will provide an excellent starting-point for the new long-term leader.

The quality of CIAT science remains good, and the Panel has suggested only minor adjustments in the work of the various programmes. Natural resources management research has got off to an impressive start, and is at the cutting edge within the region. The NRM programmes are, however, facing serious funding shortages and we have recommended some options for focusing and consolidation; these can be considered by the incoming Director-General and the Board.

The External Review has itself gone through some difficult changes following the withdrawal of Grant Scobie as Chairman of the Panel, and the illness of the Panel Secretary, Vivian Timon, while on his way for the main phase. I would like to thank the Panel for helping me patiently as I took over my unexpected task, and above all to express my gratitude to Mike Collinson for stepping in at a moment's notice and carrying through in an exemplary manner the duties of Secretary. The Panel consultants (Joan Joshi, Alphonse Emechebe and Miguel Cauhépe) and the resource persons (Pammi Sachdeva and Mike Collinson wearing his original hat) have made outstanding contributions, and enabled the Review to cover much more ground than would otherwise have been possible.

Last but not least, the Panel's thanks go to the Board, Interim Director-General and staff of CIAT for the uncomplaining and even enthusiastic manner in which they have met all our requests and offered us their hospitality. We are grateful also to the many national scientists and officials who shared their insights with visiting Panel members.

We trust that our report will serve to strengthen CIAT, and thus the CGIAR system.

Yours sincerely,

A handwritten signature in dark ink, appearing to read 'Declan Walton', written in a cursive style.

Declan Walton
Chair, CIAT EPMR Panel

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(CIAT)

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TAC SECRETARIAT
FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

February 1995

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FOREWORD

This is the Report of an External Panel appointed to review the programme and management of the International Centre for Tropical Agriculture (CIAT). The membership of the Panel and their backgrounds are listed in Annex I.

This Fourth External Review of CIAT was commissioned in 1993, with the initial phase and country visits planned for late 1994 and the main phase for early 1995. The full Terms of Reference for the Review are detailed in Annex II. In the context of the TAC Standing Committee on Reviews search for reduced costs, this Fourth Review of CIAT, a complex Centre, consisted of a Chair, a small Panel of four members, three part time consultants, two resource persons and a Panel Secretary.

A consultant attended the July 1994 CIAT Board Meeting in Cali, and the first phase, with Dr Grant Scobie as Chair, was implemented in September/October 1994. It included one week at CIAT Headquarters during which the Panel met with all levels of CIAT staff to solicit their views. CIAT presented the Panel with excellent documentation on all aspects of its operations. A list of the documents provided to the Panel is at Annex IV. After this week the Panel, consultants and resource people divided into small groups for visits to countries, regional organisations and IARC's with which CIAT collaborates. A full list of institutions and individuals visited is included as Annex III. Further information was gathered by the Panel through two survey questionnaires, one circulated to CIAT staff and the other to NARS collaborators.

In the interim, before the main phase, Dr Scobie withdrew as Chair of the Review, the result of a conflict of interest when he was named to the shortlist for the vacant post of CIAT Director General. Mr Declan Walton agreed to step in at short notice as Panel Chair for the remainder of the Review. This allowed the original timetable for the main phase, January/February 1995, to be kept. En route to the main phase the Panel Secretary, Dr Vivian Timon, was taken ill, and Dr Mike Collinson, a resource person for the Review, took his place. The main phase was implemented, and the Review concluded, without further incident.

The Panel cannot claim to know everything about all of CIAT's work. Given the events of the past five years, some aspects inevitably received much more attention than others. The Panel believes that it has focussed its efforts where these were most needed, and that it has responded to its Terms of Reference. It is the Panel's hope that the report will be useful to the TAC, the CGIAR and of course, to CIAT itself.

SUMMARY AND RECOMMENDATIONS

Introduction

This summary complements Chapter 10 of the report which is headed 'Overall Assessment and Future Directions'. It looks at CIAT's evolution since the last External Program and Management Reviews in 1989, and anticipates future change in CIAT. Before tracing this period of change the summary confirms CIAT's effective performance.

CIAT Continues to Build a Record of Achievement and Impact

The Centre organised a strong NARS input into its 1991 Strategic Plan and has increasingly drawn NARS into decision making. Several CIAT sponsored networks are managed by NARS steering committees and both NARS and regional organisations are partners in the emerging CIAT-convened consortia.

All the Commodity Programmes have accumulated additional evidence of adoption since the last review, and the Panel was impressed both by the role being played by CIAT germplasm and by the enhanced efforts of the Centre to document its impact. The newly formed Natural Resource Management Programmes have already made an impact. An 'achievement and impact' section is included in each of the Programme sections of the report with an overall assessment of impact in section 5.4.

CIAT is a Changed Centre Since 1989

CIAT is a changed Centre from the one reviewed in 1989. It has been an innovator in the ecoregional approach to research advocated by the CGIAR in response to rising global awareness of environmental damage from unsustainable agricultural practices. CIAT's 1991 Strategic Plan initiated four NRM Programmes, three in individual ecosystems; the Andean Hillside, the Forest Margins and the Savannahs, and a fourth umbrella programme to understand policy effects on land use systems at an aggregate level.

The Centre deserves credit for its early initiatives in NRM and for the introduction of a well conceived ecoregional approach to research. Even before 1991 the Agroecological Studies Unit, precursor of the present Land Management Group, applied GIS to identify three priority ecosystems on which to focus CIAT's NRM efforts. CIAT's history of on-farm research and its experience in participatory methods formed a solid foundation for initiating on-site work, particularly in the smallholder communities of the Hillside and Forest Margin ecosystems. Finally, the Commodity Programmes have ably supported experimentation within the watershed-based NRM sites.

The CGIAR funding crisis was a second force driving CIAT managers over the last five years. It began almost as CIAT launched its 1991 Strategic Plan. In the face of the failure to secure adequate new funds CIAT downsized its commodity programmes and training more rapidly than had been planned, and used the released funds for some expansion of NRM research.

With the funding crisis and the need for urgent response, CIAT has sometimes short-cut the NARS consultation process. Training was radically downsized through 1993. Network devolution has sometimes been paralleled by the premature withdrawal of CIAT technical support. There have been critical reactions from some affected NARS.

CIAT Must Change Further

Two developments are reorienting CIAT from the commodity approach which dominated its organisation in 1989.

- First, the ecoregional approach to research on the sustainable improvement of productivity involves strong interdisciplinary efforts from a wide range of natural and human sciences. It has drawn commodity programme staff into collaborative research on farmers' fields within the NRM sites.
- Second, and more recent, CGIAR systemwide initiatives, seeking across-centre synergies on important strategic themes, are providing a new focus for CIAT's competency groups, the Units and recently formed SRGs.

These developments are drawing CIAT into two very different research modes, inter-disciplinary teams on the one hand and discipline-based competency groups on the other. If managed well this emerging dichotomy will pull down the walls of what was sometimes referred to in the past as a "4-in-1 centre".

It was impossible for CIAT to avoid damage as it scaled down its activities to manage the reduction in funding. The attempt to balance CIAT commodities research with NRM programmes, in the face of declining funding, took its toll on CIAT management and staff. While the Centre was preoccupied with crisis, the gap between top management and staff, noted even in calmer times by the 1989 external review, widened drastically. It is clear now that the Centre has turned the corner, but it is vital to staff morale and CIAT's effectiveness that further change, implemented in a participatory spirit and a transparent way, close this gap completely.

This will require genuine staff participation in decision making and a management focus on internal cohesion. The 1989 review recommended that programme leaders be included in the management committee. Although the organisational structure is now different, this 1995 review again seeks a greater role for programme leaders in

management decision making, this time by invigorating the committees to which they already belong. When internal cohesion is enhanced the Centre will be better able to undertake further expansion in collaborative activities with national, regional and systemwide partners. The key to internal cohesion and a new CIAT culture will be the leadership and style of the new Director General.

Conclusion

The Panel believes CIAT's initiative in natural resource management is important to the Centre and to the CGIAR. Expansion should continue, not at the expense of the commodity programs, but at a pace at which new funding is attracted by present performance. Consolidation is important for the immediate future. The Panel has put forward options on several points in order to leave the Board and the incoming Director General with flexibility.

The Panel hopes that its recommendations will help foster a more participatory CIAT culture and contribute to a Centre as successful in the sustainable improvement of agricultural productivity as it has been in germplasm and human resource development.

RECOMMENDATIONS

Chapter 2 - Commodity Research Programmes

1. The Panel recommends that the Bean Programme give higher priority to research on nitrogen fixation and nutrient cycling in bean production systems, particularly in Africa.
2. The Panel recommends that CIAT undertake genetic and ecophysiological research to increase both yield and viability of the seeds of the most important tropical grasses and legumes.

Chapter 3 - Natural Resources Management Research

3. In view of the limited resources available for CIAT's NRM work, the Panel recommends that:
 - the number of research sites be reduced;
 - Board and Management consider the options for consolidating existing programme structures (Chapter 3.5);
 - the Land Management SRG become either a programme or a unit depending on the orientation that CIAT considers more appropriate to its future (Chapter 3.4).

4. The Panel recommends that CIAT establish a Soils Unit, which should follow an integrated approach with emphasis on organic matter, soil biota and nutrient cycling. The funding of a Soil Biologist to be located in the Unit should be given a high priority.

Chapter 4 - Research Support

5. A new head of the GRU should be appointed as soon as possible. Experience is need in strategic thinking on genetic resources, as well as in marker technology and the computing aspects of population genetics/dynamics.
6. The Panel recommends that CIAT establish more biosafe greenhouse compartments for contained experiments, in line with its own biosafety guidelines.
7. The Panel recommends that CIAT should only undertake field trials with transgenic materials after obtaining approval from the government concerned.
8. The Panel recommends that the VRU, in collaboration with relevant entomologists, devote greater attention to the epidemiology of major virus diseases of CIAT's mandate crops, as a prerequisite to integrated control of both viruses and their vectors.
9. The Panel recommends that CIAT incorporate the Biometry Unit into a broader unit, headed by a senior scientist, to handle scientific data management and decision support systems.

Chapter 7 - Research Management

10. The Panel recommends adoption of the organizational structure depicted in Chapter 7, Figure 1, of which the main elements are:
 - Establishment of a position of Associate Director for Research Support and Information Services in place of the existing post of Associate Director for Natural Resources Management;
 - The research support units and the units handling information systems and services should report to the new Associate Director.

11. The Panel recommends the use of the matrix depicted in Chapter 7, Figure 2, to describe the conceptual interaction between competency groups (which include both SRGs and Units) that provide input and the research programmes that are essentially responsible for output. All research projects should continue to be implemented within Programmes or Units.
12. The Panel recommends that management engage scientific staff in project definition and ensure that all programme heads and project leaders are fully aware of all aspects of project management and budgeting.
13. The Panel recommends that, in its consideration of candidates to fill the position of Director General, the Board carefully consider the importance of a leadership style that will reintegrate the CIAT community and encourage participation in decision-making processes by programme leaders and scientists.

Chapter 9 - Financial and Human Resource Management

14. The Panel recommends that the Operations and Programme Committee regularly monitor the adequacy of staff numbers in each research programme and discipline, and advise the DDG (Research) on any corrective measures needed. Such monitoring should cover not only the senior scientists but all other research staff as well.
15. The Panel recommends that the performance assessment system be suitably modified to improve the performance planning and feedback processes used by supervisors, and to strengthen the standard-setting and monitoring roles of the DDGs and Evaluation Committee.
16. The Panel recommends that a strategic plan for the development and organization of information systems in CIAT should be formulated as soon as possible, for consideration by Management and Board. The emphasis should be on establishing a coherent Centrewide system, rather than on hardware and software problems.

CHAPTER 1 - EVOLUTION AND STRATEGY

1.1. Origin, Mandate and Role of CIAT in Tropical Agriculture

The Colombian Government and the Rockefeller Foundation signed an agreement to create CIAT on 12 May 1967. The Centre was officially decreed a Colombian institution in November 1967. By the time CIAT's facilities at Headquarters were dedicated on 12 October 1973, the Centre had become one of four 'founding' centres of the CGIAR. In 1977, at the CGIAR's request, the Board recognized global responsibilities, going beyond the regional responsibilities that the foundations originally emphasized.

CIAT's original mandate stated its objectives as being:

" To generate and deliver, in collaboration with national and regional institutions, improved technology which will contribute to increased production, productivity and quality of specific food commodities in the tropics, principally countries in Latin America and the Caribbean, thereby enabling producers and consumers, especially those with limited resources, to increase their purchasing power and improve their nutrition."

There were no changes in CIAT's mandate from 1984 until the third External Review in 1989. Soon after that Review, in April 1991, CIAT published its current strategic plan, 'CIAT in the 1990s and Beyond'. A supplement to the plan discussed the global and regional trends underpinning it. While later circumstances have required revisions of the original medium term plan based on this strategy, CIAT's board and management have consistently made these revisions within this 1991 strategic framework.

1.2. CIAT's Strategic Plan

1.2.1. New Operational Mandate

The 1991 strategic plan included a restatement of CIAT's operational mandate which is quoted below:

"CIAT will contribute to technology development that will lead to long term improvement in the productivity of agricultural resources; to the development of innovative, more cost effective, agricultural research approaches and methods; to the strengthening of research institutions in participating countries; and to the development of inter-institutional linkages. To that end CIAT's activities centre around the following three areas;.... Germplasm development research,resource management research in tropical America... and institutional development."

The restated operational mandate then elaborated the geographical scope of each commodity mandate and of the resource management research initiative.

1.2.2. The Strategy

The centrepiece of the 1991 strategy is the recognition that CIAT's traditional commodity research alone is unlikely to achieve sustainable agricultural development. The plan introduced natural resource management research to CIAT and, from 1991 to 2001, proposed to expand in this new programme area to balance the centre's commitment to germplasm improvement.

The 1991 CGIAR paper on system expansion, and its 1992 revision of CGIAR Priorities and Strategies, moved the CGIAR as a whole towards a greater balance between germplasm development and natural resource management research. The CIAT strategy paper was a pioneer effort by a centre to implement this change in orientation. Other initiatives in the 1991 paper reinforced the ongoing shift into advanced laboratory science, and stressed the need for new forms of collaboration. These forms, across the wider range of institutions and skills, are needed to address the complex task of improving productivity while maintaining the resource base.

The 1991 plan summarized CIAT's strategy as follows:

"Germplasm development research will be directed at characterizing and broadening the genetic base of selected commodities, and at understanding the gene-governed mechanisms determining plant adaptation and productivity in major production areas, including the ecosystems of tropical America selected for intensive agroecological research. The aim is to develop the potential of germplasm resources for increasing output and efficiency of input use.

"Resource management research will focus on important tropical American agroecosystems which are threatened by increasing land use intensity or natural resource degradation, as well as those which may have the potential for relieving such pressure. The aim of research will be to understand the basic processes within the agroecosystems in order to make agriculture more sustainable.

"This integrated approach will be pursued within a framework of inter-institutional cooperation aimed at enhancing complementarity and increasing cost-effectiveness in research at the national, regional and international levels."

The strategy foresees a strong interaction between research on CIAT's priority commodities (cassava, rice, beans and tropical forages), and CIAT's priority ecosystems (the middle hillsides, savannahs and forest margins of tropical America). CIAT's accumulated knowledge from its traditional crop improvement programmes was clearly an important criterion in selecting the ecosystems for its new natural resources initiative. It has potential as an example of the synergies sought by the CGIAR through the ecoregional approach to research.

The strategy for the natural resource management initiative will be to integrate options in land use and farming systems that help relieve market and social pressures on fragile environments. Implementation will see activities at two levels of aggregation: at the sectoral level, emphasis will be on understanding the policy needs to mobilise alternative land use strategies; at the production level, emphasis will be on generating and integrating technologies into production systems which are agroecologically sound, input use efficient, and economically viable.

The plan also foresaw that an institutional model which is increasingly collaborative implies more decentralized execution and greater reliance on the integration of information and the efficiency of communications.

1.3 CIAT Today

A Medium-Term Plan 1992-96 was developed from this strategy document and submitted to TAC in May 1991. It was revised to cover the 1993-98 period and resubmitted to TAC in May 1992. Based on the 1991 strategy, CIAT reorganised its programme structure in June 1992.

The failure to attract new funding required a number of planning adjustments. In November 1993, the Board approved an Action Plan to accommodate what had by then become a deteriorating funding situation. CIAT has been implementing the Action Plan since that time. The Centre submitted a 1994/95 Programme and Budget to TAC in August 1994, and a Programme and Budget for 1995 to TAC and the CGIAR in October 1994.

Table 1.1 below sets out the centre's 1991 expectations of a 20% increase in senior staff over the decade 1991-2001. Within this, the number of scientists in germplasm development was expected to fall by 28%, from 65 to 47, and the number in resource management to increase from 1 to 34. Actual 1994 totals are included in a final column for comparison.

**Table 1.1: Planned Core Resource Allocation (Senior Staff Years) for 1996 and 2001,
with actuals for 1991 and 1994**

	1991	1996	2001	1994
Germplasm Development	65	51	47	47
Resource Management	1	30	34	17
Institutional Development	6	8	8	5
Management etc.	10	9	9	7
Total	82	98	98	76

Source: 'CIAT in the 1990s and Beyond - A Strategic Plan', p. 68, Table 5.1 and 1994 data added.

As the table shows, CIAT's expectations of increased funds to add senior staff years were not realised. Indeed, CGIAR funding, and CIAT's with it, began to decline in real terms in 1991. By 1994 CIAT had downsized its germplasm development group to the level proposed for 2001, but had only managed to build up the resource management group to half the strength intended for 1996. Both Institutional Development and Management and Administration had also been downsized by 1994 to permit even this rebalancing.

CIAT retains four commodity programmes in beans, rice, cassava and tropical forages. It also has two new programmes in natural resource management research: Tropical Lowlands, subsuming two other priority ecosystems (the savannahs and forest margins); and Hillsides. It has also expanded its analytical capability in Land Use, built up from the earlier Agroecological Studies Unit. Thus, despite funding setbacks, CIAT is a very different centre today from what it was in 1989.

CHAPTER 2 - COMMODITY RESEARCH PROGRAMMES

2.1. Introduction

Within the CGIAR system, CIAT has the global mandate for beans, for cassava, and for tropical forages for acid soils. It has a mandate for rice in Latin America and the Caribbean. A CIAT study, prepared for the strategic plan of 1991, assessed the production and consumption patterns of 19 commodities in Latin America, and confirmed the importance of these crops.

The world production of dry beans (*Phaseolus vulgaris*) is about 10 million MT annually, 79% occurring in developing countries. The major production areas are Brazil (2.43 million MT), the highlands of eastern and southern Africa (2.26 million MT) and Mexico (1.11 million MT). The proportion of world production that takes place in Latin America is 46%, and in sub-Saharan Africa 25%. Beans are an important and cheap source of protein, calories, and minerals in the diet, and can enhance the use of rice and maize protein. In developing countries, beans are predominantly produced by small farmers. Demand for beans is projected to grow by 3.0% annually in Africa, and 1.7% in Latin America. Market trade in beans is increasing in both continents. The public sector develops almost all new varieties. This makes CIAT's support of the NARS all the more important. The Bean programme collaborates with NARS directly, but more often through a series of regional networks. The programme has been considerably reduced in size since 1989, and now has 12 fewer Senior Staff and much reduced activity in crop management research. It has undergone the largest budget change of any of the four commodity programmes.

Cassava is an important food for over 500 million people in Africa, Asia and Latin America. World production, confined to developing countries, has increased by 21% in the last decade to 154 million MT in 1993, with 29 million MT in Latin America, 21 million MT each in Nigeria and Zaire, 20 million MT in Thailand and 16 million MT in Indonesia. About 16 million ha is harvested annually with 60% of the area in Africa, 24% in Asia and 16% in Latin America. Area is increasing faster than yields, reflecting the movement of production into more marginal soils and/or areas of lower rainfall. Cassava is critically important to food security for households in sub-Saharan Africa and is an increasing source of cash income in all producing areas. Small-scale farmers and processors predominate in cassava production and in its transformation into food stuffs. Europe and Japan import about 15% of the production as chips or pellets, and starch. CIAT has made an important contribution to developing small-scale processing methods. In Africa, IITA takes the lead role in cassava research, CIAT collaborating particularly in providing germplasm to IITA, and in shipping natural enemies of insect pests such as the cassava mealybug and cassava green mite.

Rice production in Latin America and the Caribbean has nearly doubled since 1967 to about 19 million MT of paddy per year, produced on 7.3 million ha. Irrigated areas produce 60%, mostly from new varieties. CIAT has worked closely with Latin American NARS in variety development, and in facilitating the International Network for the Genetic Evaluation of Rice in Latin America and the Caribbean (INGER-LAC). About 40% of the nearly 250 varieties released in LAC since 1967 originated from CIAT and 15% directly from IRRI. Yields of irrigated rice have increased by 44% to a regional average of 4.6 MT/ha but there is much potential for further increases through new plant types and improved crop management. Rice consumption increased and prices fell during this period. Recently upland rice yields have increased as new higher yielding varieties have been released. CIAT has developed germplasm that is acid soil tolerant, and new management systems for both small farms of low-input and large, mechanized production systems. The land area potentially available for upland rice production is very large.

Forages are the basis of most animal production in the tropics. Natural and improved pastures can be managed to sustain or improve soil fertility and control erosion. Tropical savannahs cover about 20% of the earth's land surface or 23 million km². Savannahs comprise about 63% of the land in Africa, and 45% in South America, or more than 243 million ha. The Brazilian Cerrado predominates with 180 million ha, but there are also large areas in Colombia, Venezuela, Bolivia and Guyana. There is an increasing need for improved germplasm to expand the area of improved pastures and complement the native vegetation in the savannahs, hillsides and former forest areas.

Demand for beef and milk is rapidly growing in tropical countries. It is estimated that by the year 2000 demand will exceed production by 356,000 MT for beef and 8.9 million MT for milk in tropical America. The consequent need for improved forages will greatly stimulate the forage seed trade.

Since 1989, the Tropical Forages Programme has evolved from the much larger Tropical Pastures Programme. It aims to develop forages for farming systems in the humid and sub-humid tropics that will contribute both to increased and more efficient meat and milk production and to more sustainable production systems. CIAT's activities in management of animal production have decreased during this period. Some of the former programme personnel and activities were transferred to the Tropical Lowlands Programme. The research approach has been to select wild legume and grass forage species with improved production potential to overcome specific constraints by recombination and selection, and to integrate forage production into food-grain crop production systems. The ways in which CIAT's Tropical Forages Programme will be coordinated with ILRI's Livestock Programme are still under discussion. There is a regional forage network in south east Asia.

The delivery of improved planting materials to the farmer is an important objective for all commodity programmes. They are working with the Natural Resources Management Programmes (Hillsides and Tropical Lowlands) in testing germplasm and new

production systems on farm. The African Bean Programme is likewise involving farmers in cultivar selection, seed multiplication and new ways of growing the crop.

The commodity programmes support extensive, multicountry networks of NARS (see Section 6.1.6).

2.2. Beans

2.2.1. Evolution

CIAT holds the global mandate for bean research. The Bean Programme has seven Senior Staff at CIAT Headquarters, two outposted in Latin America and seven in Africa. The Programme goal is to "make a lasting increase in food availability and the incomes of the poor by improving bean productivity through technology developed in collaboration with national institutions". The Programme achieves this by germplasm improvement and strengthening the NARS capacity through bean research networks. Networks are the main recipients of the improved germplasm.

CIAT maintains the largest global collection of bean germplasm and related species. The Programme operates as a multidisciplinary team with project areas on *Phaseolus* diversity, bean yield stability, and sustaining bean productivity in both Latin America and the Caribbean and sub-Saharan Africa.

Since 1990 there has been a 41% reduction in Senior Staff, a 47% reduction in scientific and supervisory staff and a 39% reduction in the Budget to US\$ 5.8 million. In 1993, non-core funding contributed US\$ 2.01 million. A further Senior Staff position in Latin America will terminate in 1996. A 1992 external review of the Bean Programme was considered by CIAT's Programme Committee.

During this very rapid reduction, dialogue with Senior Management was difficult and this hindered development of a phased transition to minimise loss of materials and intellectual capital, and maintain morale. Programme Leadership has also changed. The transition to a new level of activity has been successfully negotiated, but laying the foundation for development of new technologies is proving difficult with constrained resources.

The Programme has recognised that technology *per se* will not close the gap between experimental station and farmer yield. It requires an understanding of the socioeconomic and anthropological dimensions of the change process in rural communities. To this end, the networks are involved with CIAT staff in developing on-farm, farmer participatory experiments on production methods, cultivar selection and seed production.

2.2.2. Achievements and Impact

Genetic Diversity

The Bean Programme has made an important conceptual advance in its use of germplasm. A morphological and biochemical classification of beans combined with knowledge of agroecological regions of adaptation of the accessions in the germplasm collection and supported by a GIS analysis resulted in the identification of two major genepools. These are the Meso-American and the Andean with six major races of common bean. The work influenced the way basic germplasm materials are selected for testing and crossing. In 1993, the Programme developed a core collection of 1,500 entries from the 25,000 accessions held at CIAT - about 1,200 from primary centres of origin and 300 from secondary centres such as Africa. The GIS approach has also highlighted sites for further collecting, particularly of wild bean ancestors. A core-funded, senior staff position was created within the Bean Programme to characterise and use CIAT's germplasm collection more effectively.

Molecular markers, seed protein patterns, and phenotypic morphological characters have further characterised genetic diversity in the core collection. Awareness of these methods to analyze bean genetic diversity is increasing in the NARS and should greatly improve the ways bean germplasm is used.

Germplasm Development and Release

The Programme has recently refined breeding strategies to use the potential for recombination among the Meso-american races. Recombination between the two major Meso-American and Andean genepools remains an important challenge. CIAT is seeking ways to bridge these pools and to develop plants with desirable form and phenology. The main strategy for improving yield potential of Andean types is to increase indeterminacy and delay maturity. In 1994, two breeding nurseries were merged to create the biennial International Bean Nursery (IBN) containing around 500 entries. The Programme encourages NARS to contribute lines and to evaluate the IBN for constraints or adaptation in the local environments. The IBN is expected to become a major vehicle for international collaboration in bean improvement.

Over the last five years, NARS have released 61 lines developed at CIAT as cultivars in 21 countries. CIAT has also facilitated the release of 9 cultivars from other countries. By 1992, about 705,000 ha were planted to 135 varieties developed or distributed by CIAT. This is about 7% of the total area in new varieties. In Central America, 38% of the total area sown (175,000 ha), is planted to these new, CIAT-initiated varieties. In four states of Brazil, 23 CIAT based varieties accounted for a quarter of the area sown to new varieties. Another CIAT line, resistant to four diseases, is the second recommended variety in 12 Brazilian states. The African programme has 13 CIAT-introduced lines released to farmers in five countries with encouraging adoption rates. The value of increased

production attributable to CIAT materials is about US\$ 87 million per year with a 24.5% internal rate of return on funds invested in CIAT bean research since 1973. A study of the impact of 203 cultivars released in Latin America shows there has been steady progress in increasing diversity, traceable to increased use of interracial crosses.

Resistance Breeding and IPM

The Programme's approach to developing new plant materials is first to define the pests and environmental conditions affecting yield stability and then to assess variation in the germplasm response to them. The Programme has characterized races of the fungal pathogens causing angular leaf spot and anthracnose, and demonstrated probable coevolution with bean gene pools. Strains of Bean Golden Mosaic Virus (BGMV) were also identified. Molecular genetic markers to indicate pathogen variation and identify strains are now in use. It has likewise differentiated common bacterial blight organisms into two groups. This information helped in the development of new, stable sources that are disease resistant for anthracnose and angular leaf spot, and will aid in pyramiding resistance genes in the one cultivar. The Programme has undertaken genetic analyses of tolerance or resistance to diseases.

For Africa, new CIAT materials have resistance to Bean Common Mosaic Virus and angular leaf spot, the most important biotic constraints to production. There are IPM systems and selected populations developed at CIAT Headquarters for tolerance of bean stem maggot, the worst insect pest in East Africa. Selected cultural practices and resistant bean populations control root rots caused by *Fusarium*.

The Programme is managing insect pests through developing host plant resistance, including a crossing programme with other *Phaseolus* species, and exploring the potential for use of insect deterrent factors in bean seeds, such as the protein arcelin. Segregating lines with multiple resistance to pod weevil, BGMV and anthracnose are being evaluated in Honduras. IPM systems for white flies, leafminers and pod borers, developed for small farms in Colombia, Peru and Ecuador are ready for pilot project development.

Tolerance of Low Soil P-Levels

Soil fertility has a major effect on bean production in farmers' fields with phosphorus the major limiting element on 60% of the area in Latin America and Africa. As fertilisers are unavailable or expensive, CIAT considers genetic improvement of P uptake and P-use efficiency as its primary strategy. Greenhouse field studies and GIS analysis identified germplasm from specific geographic regions as likely to tolerate low P-soils. This work gained new impetus with the appointment of a plant nutritionist in 1993. The Programme is developing new methods of screening beans for response to low P levels in soil solution, and has incorporated promising genotypes into a low soil fertility breeding programme. Field screening continues at three sites in Colombia and four in Africa. Cultural practices to increase soil fertility and reduce erosion are also under development in the African networks.

Nitrogen Fixation

Beans nodulate and fix nitrogen but often not well, particularly in Africa. CIAT has shown this can be due to host - *Rhizobium* genotype incompatibility, and/or low numbers of rhizobia in the soil. CIAT also contributed to the selection of *Rhizobium* strains now used commercially in Cuba and Peru. But in field trials, seed inoculation has seldom improved poor N-fixation. A collaborative project with CAMBIA to study factors affecting the competition between inoculant and indigenous *Rhizobium* strains has developed new molecular genetic techniques. The potential interaction between soil P levels and N-fixation are being examined. Glasshouse studies have identified lines with superior capacity for N-fixation, but field selection now relies on total plant N uptake. The bean team has developed non-nodulating lines as a control for measurement of N-fixation in the field.

Photoperiod Sensitivity

The Programme is using genetic manipulation of photoperiod sensitivity to find ways of improving plant phenology and yield potential without introducing the climbing habit. The inheritance has been elucidated and crosses made to produce day neutral, intermediate and photoperiod sensitive responses in elite, inbred lines. This has similar potential to the use of photoperiod sensitivity in developing soybean varieties, matching the cultivar phenology to the expected seasonal pattern of temperature and water availability.

Adaptation to Water Deficit

Selection for drought tolerance emphasizes yield selection, following inheritance and selection studies in Colombia and Mexico. In 1993, the Programme released its first lines selected for drought tolerance. Desiccation postponement through greater root growth, drought escape through earliness, and increased water use efficiency appear to be important mechanisms across genepools.

Networks

CIAT has initiated five Bean Research Networks: PROFIJOL in Central America and the Caribbean, PROFRIZA in the Andean Zone of South America, RESAPAC in the Great Lakes Region in Africa, EABRN in Eastern Africa and the Regional Project on Beans in Southern Africa. All bean networks are dependent on special project funding. PROFIJOL coordinates the CAC network and devolution is underway for other networks.

CIAT encourages greater participation of farmers in the research, cultivar selection and seed production processes, particularly in Africa. Coupled with the formation of farmer community groups, this development has much potential to speed up the process of technology adoption.

This is illustrated by the remarkable uptake of CIAT varieties, particularly of climbing beans, in Rwanda. CIAT began working with ISAR, the national research system, in 1984. By 1992, four out of ten farmers, or 500,000 families, were planting climbing beans, an 8-fold increase. There were production increases of up to 38%, with the new beans occupying 11% of the total area planted to beans. This experience helped CIAT in its role as coordinating agency for the NARS, the NGOs, the donor community and four CGIAR Centres in the Seeds of Hope Mission to Rwanda to re-establish the supply of adapted varieties for farmers to plant after the civil war.

CIAT staff have visited Eastern Europe where Rumania is a large producer on 600,000 ha; the possibility of a network is under discussion.

The relationship between CIAT Headquarters and the Pan-African Bean Programme is special because its size. Although the line responsibility lies with the Programme Leader, staff report to the Pan-African Coordinator who reviews their activities and performance. Reciprocal annual visits by the Bean Programme Leader and the Pan-African Coordinator are planned, with somewhat less frequent visits by other Programme staff. The Pan-African Programme has recently instituted an efficient financial system managed from Uganda. Financial information is transmitted to CIAT Headquarters but delays in receiving updated information from Headquarters on expenditures create problems for the African Programme in reporting to donor review meetings. This exchange needs to be streamlined.

2.2.3. Future Strategy

Consistently, the Bean Programme has given highest priority to NARS collaboration and support, mainly through networks. Devolution of management of these networks to the NARS will continue with CIAT's role becoming one of technical and communications support. The work on characterising the CIAT bean germplasm collection will continue to build the framework for more effective and efficient use of this unique resource. This will be coupled with analysis of genotype by environment interaction. The selection and breeding of materials which are resistant to, or tolerant of, biotic and abiotic constraints will be the approach to achieve yield stability. CIAT will increasingly supply the NARS with segregating material rather than lines.

Use of molecular genetic techniques to clarify host-pest interactions, and of molecular markers to follow resistance traits in crossing programmes, will speed development of stable lines with tolerance/resistance to pathogens and insects. These host plant resistances will underpin the development of IPM systems in Latin America and Africa.

The goal of improving P uptake from low fertility soils will continue through collaborative research with the University of Costa Rica. Selection for improved P-nutrition will be coupled with selection for improved N-fixation. Use of molecular markers as strain

identifiers will help determine the parameters which affect *Rhizobium* competition in forming nodules and should lead to improved seed inoculation procedures and nodulation.

2.2.4. Overview and Assessment

The Programme is to be commended for the balanced manner in which it has reduced and modified its activity in response to the last review and declining resources, particularly in the area of Headquarters versus country operations. This is approaching parity but most of the country operations (and basically all staff positions in Africa) are non-core funded. The Programme has been very successful in obtaining non-core funds but this can be a precarious solution. In order to demonstrate to donors CIAT's commitment to the Pan-African Bean activity, the Panel urges CIAT to fund the position of Pan-African Coordinator from core and give consideration to funding at least one further core position for Africa. This will necessitate a different pattern of funding between Headquarters and Africa for the core-like activity in the Programme. Funds should also be sought to maintain the CIAT support for the LAC networks at the present level.

The more focused breeding programme has developed improved mechanisms for generating and testing genetic variability, particularly through a more carefully generated and smaller IBN. However, more effort needs to be given to integrating all breeding activity with other thrusts within the Programme and to more careful matching of sites to the environment or stress for which the material is being selected particularly if yield *per se* is the major selection criterion. The identification of genetic variation in nutrient uptake efficiency particularly for P and for N-fixation, photoperiod and drought tolerance provides the potential for the breeding programme to contribute a great deal to crop management practices through improved germplasm. For this to eventuate requires more efforts to develop an across-programme consensus on the way it will achieve these goals and closer attention to reducing overlap in the breeding programme in selecting for environmental tolerances.

The Programme has made significant advances in methods to identify and locate germplasm of interest for both biotic and abiotic stresses through refining laboratory, greenhouse and field screening techniques and has been innovative in its use of molecular markers and GIS. The creation of the Bean BARN demonstrates the continuing close links with the BRU and recognition of the benefits from links with other institutions as CIAT's emphasis on upstream research increases.

The Programme has made major contributions to selection of pest resistant materials which have laid the foundation for integrated pest management. Complementary funds should be sought for piloting of these methods with NARS.

Nitrogen fixation should play a large role in the nutrition of the bean plant, with flow-on effects for the sustainability of the production system. In parts of LAC and Africa this is apparently not occurring. CIAT needs to focus more attention on defining the

causes for this and on ways to rectify the problem. Furthermore, the role that the bean plays in nutrient cycling in cropping systems needs more understanding. For the African networks this may be achieved through collaboration with an overseas institution with experience in the area of plant nutrition and in optimising biological N-fixation in field crops. The Panel puts forward the following recommendation:

- 1. The Panel recommends that the Bean Programme give higher priority to research on nitrogen fixation and nutrient cycling in bean production systems, particularly in Africa.**

CIAT has developed collections of beneficial microorganisms (eg *Rhizobium*, mycorrhiza and biological control organisms) that greatly benefit plant growth, but there is at present little research on their use. There is a need to focus and coordinate the work on soil microbial ecology and to have the capacity to provide inoculants for research. To undertake this research, the Panel suggests that CIAT appoint a nationally recruited, Ph.D or M.Sc. level scientist, who could be located in the proposed Soils Unit.

2.3. Cassava

2.3.1. Evolution

Cassava is an important source of food in many countries of Latin America, Asia and Africa. In both fresh and processed form it provides income and employment for low income rural people. This crop is highly important in marginal areas because of its tolerance of low soil fertility and drought, and its recovery capacity after pest and disease damage. It is not a crop that developed countries grow or investigate. This indicates that there is a considerable need for further basic knowledge-generating research on the crop. CIAT's Cassava Programme aims to stimulate cassava's contribution to the well-being of poor farmers, processors and consumers. The Programme generates knowledge and technology components which will lead to a sustainable improvement in the production and quality of cassava and the diversification of its end uses.

CIAT has a world mandate for this crop. It is developing the cassava research programme in a way which stimulates not only its own research on this crop but also that of IITA with its mandate for Africa, that of the NARS in developing countries, and that of institutes and universities in the developed world. The outcome of this interdisciplinary research programme includes:

- germplasm preservation and developments in research on genetic conservation;
- improvement of gene pools by conventional means adapted to different agroecological zones and for quality traits;

- development of integrated crop and pest management practices for economically and environmentally sustainable cassava production;
- developments in product and market research;
- enhanced interinstitutional collaboration.

In the last five-year period, the Programme had to reduce input on agronomic and postharvest processing aspects of cassava due to budget restrictions and increased research on genetic diversity.

2.3.2. Achievements, Impact and Future Strategy

Genetic Diversity

Because of the world mandate for this crop, research on genetic diversity is important. It has been a multidisciplinary effort for many years. Genetic diversity includes developments in the areas of conservation, collection and evaluation. The Programme has screened germplasm under different conditions to identify new sources of desirable traits like resistance to (a)biotic stresses, photosynthetic capacity and quality. Fear of introducing exotic diseases still hinders quick distribution of improved germplasm to other continents. A significant start has been made in developing a genetic map of cassava for which basic information on the ploidy level of the crop is still needed. The isolation of many genetic markers will enable the detection of linkages with important agricultural traits. A number of conferences have stimulated research in, for example, the safety of cassava as a cyanogenic food crop, and postharvest deterioration. They have indicated that networking is an efficient way to develop this research.

Future research envisages a broader conservation strategy covering the primary gene pool and that of other Manihot species. The ecogeographical aspect is an important factor in this respect to fill gaps in the cassava collection. The conservation of African germplasm will receive more attention. Cryopreservation is the preferred long-term safe preservation method. Screening of germplasm for adaptation or resistance to different (a)biotic factors, like arthropod pests, diseases, drought or temperature stress, and photo-synthetic efficiency will continue to be a principal activity. A stronger emphasis will be given to defining the mechanism, control and distribution in the genepool of these adaptive characteristics.

Improvement of Genepools

A main priority is the use of selection schemes to breed cassava adapted to different agroecological zones, like the sub-humid tropics, acid soil savannas, humid tropics, mid-altitude tropics, highland tropics, sub-tropics and semi-arid tropics. Gene pools for each of these zones are created by a (cyclic) process of parental selection, crossing and progeny selection in each one. At all stages of development the enhanced genetic variability is introduced in national programmes to cover local needs.

In the past five years national programmes have released 17 improved varieties in Asia and Latin America originating directly from gene pools or indirectly from CIAT parental material. These varieties cover 200,000 ha in Asia and 40,000 ha in Latin America. Their full impact will not be felt for a few years because of the slow multiplication rate of cassava planting material and the absence of rapid multiplication systems in these areas. The estimated productivity increase of these new varieties, across ecosystems, is 19%, with a price premium of approximately 15% being paid for their increased starch content in Asia.

The evaluation of over 3,000 accessions and 150,000 clones has underpinned these improvements. The result is 112 elite breeding parents for the next breeding cycle. The NARS in Latin America and Asia have produced about 350,000 hybrid seeds for selection programmes. IITA has introduced another 290,000 hybrid seeds from CIAT. This has broadened the genetic base in Africa for breeding cassava, for example with 33 adapted clones for the semi-arid tropics. The impact of new varieties is highly dependent on acceptance by the local farmer and consumer. To involve the local farmer and to understand his insights, on-farm evaluation programmes have successfully been started in Colombia and Brazil. The breeding networks in Latin America and Asia were the most prominent mechanism for germplasm and information exchange. China and Vietnam received priority attention during the last period.

The development of broad based gene pools in different ecoagricultural systems and their release to national programmes will remain a chief goal. This long-term process of genetic recombination is needed to stabilize productivity and ensure a considerable increase in yield in the different ecosystems at the end of the next five-year period. A cycle with inbreeding will be investigated as a potential tool to eliminate deleterious alleles and to detect larger differences between quality traits. Transformation research in the biotech unit can provide another important tool for the breeder. Further exploratory research will be carried out on the feasibility of propagating cassava commercially using true seed.

Integrated Pest and Crop Management

Cassava is predominantly grown by small-scale farmers across a broad range of tropical and subtropical environments under sub-optimal conditions. Strategic and applied research has been carried out for more than 20 years in the area of 'integrated crop and pest management' (ICPM) of cassava. During the past five years research has concentrated on the biological control of mealybugs, mites, the hornworm and burrowing bug. Two mealybug parasites have been found in Venezuela and were successfully established in Colombia and Brazil. Several species of predatory mite have been found, studied at CIAT and released in Brazil by EMBRAPA and in Africa by IITA. A hornworm-specific baculovirus successfully and simply controls the cassava hornworm and has reduced pesticide use by 60% to 100% in certain areas.

The team gave priority to integrated control of root rot pathogens, cassava bacterial blight, superelongation disease and witches' broom disease. Yield increases of up

to 300% were due to many factors, including pathogen-free planting material, host plant resistance, planting on ridges, intercropping with sorghum or maize, and a set of technical recommendations. A UNDP-funded project has recently been started as a collaborative effort of CIAT, EMBRAPA and IITA for on-farm implementation of ICPM through farmer participation.

In the area of integrated crop-soil management (ICSM) the team focused attention on quality of planting materials, soil fertility and erosion control. In Colombia, moderate inputs of K and P result in a high response where there are poor soils with high organic matter. Selection of germplasm adapted to acid soils and low P and K levels was a key factor for success. In Asia, most soils are low in organic matter and relatively high in P and K. Under these conditions, green manures or N application were highly effective. The use of forage legume cover crops and live barriers were important in soil conservation practices for hillsides and tropical upland. The financial support of BMZ (Germany) and of the Sasakawa Foundation (Japan) was a key factor. It helped stimulate soil conservation research and implement farmers' evaluation of crop-soil management practices to minimize soil erosion in cassava-based cropping systems.

Strategic research on pest and disease management and low- input agriculture will continue. The two projects on ICPM in Brazil and Africa, and on ICSM in Asia, are major activities for the next five-year period. The integration of plant resistances, biological control and cultural practices by participating farmers is important. Research on crop-soil management will concentrate on the seasonally dry and semiarid ecosystems. Interprogramme studies with the Hillsides Programme have been initiated. Collaboration with Tropical Lowland Programmes for cassava-based cropping systems is the next step.

Product and Market Development

The impact of CIAT's Cassava Programme is often dependent on product and market development. This is of special importance where the role of cassava is changing from that of a rural staple to a multipurpose carbohydrate. Research effort focused on small scale processing of cassava in three areas:

Dry chips as animal feed: The team gave technical support to national programmes in Colombia, Ecuador, Brazil, Paraguay and Bolivia for the commercial expansion of dry cassava chip production by small farmer cooperatives.

Flour for the food industry: Industrial trials showed that because of its quality, cassava flour has market niches in food and non-food applications. Its production is in the semicommercial phase in Colombia, Ecuador and Peru.

Starch: The joint research with CIRAD-SAR on fermented starch is an interesting endeavour. Fermented starch has self-raising characteristics of importance for bakery products. The EU is financing a new project now running to develop new products

and markets for cassava in Latin America. Partners are CIAT, NRI, ORSTOM and universities in Colombia, Brazil, Argentina and Ecuador.

CIAT, CIP and IITA collaborated in the preparation of a manual on root and tuber postharvest research and development. There is a clear trend towards joint postharvest research on root and tuber crops amongst the CGIAR institutes.

The main strategies for the next five years are to create additional income-generating activities for farmers and to strengthen links with food technology, product and consumer research. It is important to collaborate with groups in developing and developed countries that possess the infrastructure and knowledge to investigate the physical and chemical and functional properties of cassava products.

Interinstitutional collaboration

Collaboration between the CIAT Cassava Research Programme, IITA advanced labs and the NARS in the most important cassava producing countries forms the core of cassava research at the global level. Of crucial importance is the recent improvement in collaboration between CIAT and IITA. A few examples of collaborative efforts are the jointly produced biennial "Cassava Newsletter", the collaborative Study of Cassava in Africa (Cosca), work on genetic resources and genetic improvement and integrated management of pests and diseases. An important part of the Programme in Latin America is the setting up and operation of 'Integrated Cassava Research and Development Projects' (ICRDP). These projects appear to be important interinstitutional mechanisms for providing closer links between production and market aspects. The EU project on the 'development of new products and markets of cassava' is an additional activity in this area. The Southern Cone Cassava Development Network incorporated a successful 'training of trainers' project with an important impact. The Programme established networking activities in Asia governed by a regional Advisory Committee of country representatives, focusing on breeding and crop-soil management. The Cassava Biotechnology Network (CBN) is another example of the important link between the NARS and the developed world through CIAT. Two scientific meetings (Colombia, 1992; Indonesia, 1994) were important for exchanging information on biotechnology and inducing and directing the desired basic research on cassava in developed countries.

Possibilities for enhance interinstitutional collaboration in the future is largely dependent on complementary funding which is not assured. New initiatives are to the ICRDP methodology to Africa, and to propose a regional Root and Tuber Network for Central America and the Caribbean with CIP, IITA, CATIE and CARDI.

2.3.3. Overview and Assessment

The Panel recognizes the outstanding way the Cassava Programme has been organised and executed. The staff, both at Headquarters and outposted, are highly motivated. It is important that the long-term vision remain clear, and that it continue to guide the formulation of shorter term research activities. A complicating factor in this crop is the low degree of basic knowledge available. It is a crop for poor tropical regions. This means that the task of CIAT with its global mandate is highly important.

The various components of the Cassava Programme are covering the different aspects of this task. However, the recent financial reductions and the simultaneous implementation of the new strategic plan, including expansion of CIAT's research area, did do some harm to this commodity programme. Parts of cassava research needed for implementation of the results by the NARS and the farmers have been stopped. This has decreased the speed with which new improved varieties become available, and also their impact. The Panel feels it is important to note this setback.

While CIAT's new Action Plan was circulated to NARS after Board approval, it was not known to the national partners with whom it was discussed by Panel members. There were, of course, special circumstances in the speed with which the Action Plan had to be drawn up. As a general practice, the Panel urges CIAT to discuss major changes in the Programme with its partners in order to arrive at an integration of research with gaps being systematically filled and overlaps being avoided.

The Cassava Programme must continue to be a model for good integration with the new ecoregional programmes, so as to strengthen CIAT's research and its internal cohesion.

The Panel urges CIAT to press for arrangements that would permit the two-way intercontinental exchange of germplasm. This would allow the Centre to use germplasm from Africa in its programme for Latin America and Asia.

The molecular marker technology can only be of practical value when plant populations, segregating for a number of important traits, are available. The Panel proposes that localization of resistance to ACMV should be made at CIAT using DNA from a segregating population of cassava from IITA.

Maintenance of the cassava collection should be rationalised, with more time being devoted to evaluation and basic aspects of germplasm development.

CIAT's research on cassava processing and on product and market development has many aspects in common with work being carried out by IITA, NRI, CIRAD and several NARS and by CIP on potato and sweet potato. The Panel feels that inter-centre integration of this research could avoid overlap and partially compensate for the

decrease of research in this area at CIAT. This might be considered by the Inter-Centre Review of Roots and Tubers. It should be stressed that for successful integration to occur a minimum core competence must be maintained in CIAT. Core competence has slipped below optimal (though not below minimum) level.

The Panel favours the development of contacts by CIAT with large processing industries in order to indicate the potential of cassava, and promote diversification of end uses. If this were to lead to forms of cooperation, the independent position of CIAT would have to be ensured.

2.4. Rice

2.4.1. Evolution

A collaborative rice hoja blanca virus (RHBV) resistance breeding project between the Rockefeller Foundation and the Colombian Government operated for 10 years. In 1967 (with the founding of CIAT) this metamorphosed into one of CIAT's base commodity programmes. The initial objective of CIAT's Rice Programme (RP) was to effect a Green Revolution in LAC driven by irrigated rice. CIAT later modified the agroecological focus to include rainfed lowlands and well-watered uplands.

Within the CGIAR system, IRRI has global responsibility for rice while CIAT has regional responsibility for LAC, and WARDA for Western Africa. CIAT's RP conducts strategic research on problems where it has comparative advantage because of its location, i.e. issues that are unique to major rice ecologies of LAC. At the same time, CIAT closely collaborates with IRRI, WARDA and CIRAD to capture, adapt and deliver global strategic advances to LAC.

Among others, the RP's research agenda included: blast disease, savannah soil acidity, agronomic and socioeconomic studies, and IPM/ICM. By 1989, the maximum eight core scientist positions had been attained; these were supplemented by one CIRAD breeder and one JIRCAS physiologist, thereby constituting a critical mass for this LAC rice improvement programme.

With the unexpected CG Systemwide downward trend in funding during the early 1990s, and the simultaneous compelling necessity for CIAT to conduct natural resources management research, the core positions were reduced to 3.7 by mid-1994, with a concomitant reduction in the programme's research agenda. The appointment of an interim Programme Leader in late 1994 increased the core positions to 4.7 in 1995. However, with the expected termination of appointments of the Programme Leader (PL) and the Irrigated Rice Breeder by December 1995 and the addition of a 0.5 entomologist position by August 1995, as well as the reinstatement of the socioeconomist position in 1996, the RP will have 5.2 SYs from 1996. The situation has been exacerbated by the phasing out of CRIN in 1992 and the uncertainty about the future of INGER-LAC after 1994. However, some of the

thrust in agronomic and systems research is maintained by collaboration with the Tropical Lowlands Programme, while appropriate technical support is provided by CIAT's BRU and VRU.

Having decided, at the end of 1993, not to core-fund irrigated rice breeding, CIAT devoted most of 1994 to mobilizing financial support for devolution of the funding, management and implementation of irrigated rice research to a consortium comprising primarily the private sector and the NARS of LAC. Progress has been remarkable. In January 1995, CIAT signed bilateral agreements with one institution in each of four countries (Brazil, Colombia, Uruguay, and Venezuela) and with IICA, establishing FLAR (Latin America Irrigated Rice Fund), to be administered by CIAT, and to which total annual contributions of US\$315,000 were pledged. While CIAT expects other LAC institutions to join the fund, it will also solicit the financial support of regional and international donors.

2.4.2. Achievements and Impact

Despite the above difficulties, the RP has recorded some notable achievements during the last five years. Thus, of all irrigated rice varieties released in LAC during 1991-94, 57% (or 29 out of 51) originated from CIAT-generated germplasm. In Central America and the Caribbean (CAC), 92% (or 11 out of 12) of the released varieties were CIAT-made crosses derived from the IR-8 plant type developed at IRRI. CIAT adapted them to LAC conditions in close collaboration with NARS, including, in particular, ICA, FEDEARROZ and CORPOICA in Colombia. CIAT also developed high-yielding upland rice varieties which have been released in Colombia (e.g., *Oryzica Sabana*, released in 1991) and Brazil (e.g., *Progreso*, released in 1994).

Rice improvement in LAC has also benefitted from IRRI's and CIAT's coordination of two productive networks: INGER-LAC and CRIN. INGER-LAC is the conduit through which national breeders access the elite breeding materials of almost any rice breeder in the world. It is estimated that 38% of all varieties released in LAC is attributed to germplasm distributed through INGER-LAC between 1976 and 1993. CRIN, created specifically for fragmented and poverty-stricken Caribbean countries, depended on INGER-LAC for germplasm and conducted adaptive research on IPM, ICM and small-scale mechanization. It has been estimated that CRIN's strong training agenda increased yields of participating farmers in the Dominican Republic by 46%.

Using a new technique (MGR-DNA fingerprinting), CIAT scientists and their Purdue University collaborators have made good progress in characterizing the genetic structure of the rice blast pathogen (*Pyricularia oryzae*). They identified 115 haplotypes clustered into six distinct genetic lineages, each one essentially consisting of non-overlapping subsets of pathotypes, pathogenic in a specific subset of cultivars. Their study of pathogen diversity revealed that the pathogen populations contain virulence for all resistance sources, but that no isolate was virulent to all rice genotypes. These results suggest that the durable resistance in *Oryzica Llanos 5* may be attributable to pyramiding of resistance genes.

RHBV and its vector, *Tagosodes oryzae*, constitute important constraints to rice production in LAC. The available resistance to each is based on a single source. However, the RP has recently identified four new sources and is using them to broaden the genetic base of RHBV resistance. Meanwhile, CIAT virologists have accomplished partial molecular characterization of RHBV, and in conjunction with RP and the Biotechnology Research Unit, are investigating novel control strategies (coat protein mediated cross protection and anti-sense strategy) involving genetic transformation of rice.

CIAT's thrust on IPM/ICM since 1989 has stimulated NARS scientists to educate farmers in Colombia, Ecuador, and Venezuela on rational insecticide and fungicide use, resulting in a substantial reduction in their unnecessary usage, e.g. Colombian farmers reduced the total volume of sprays by 55% and their number by 33%.

An economic analysis showed that anther culture (AC) use could reduce the cost of varietal development by the pedigree method by up to 26%. In 1994, CIAT started to implement a two-year technology transfer programme on AC for the rice-breeding programmes of LA.

An important result of an interprogramme project catalyzed by the RP is the identification of silicon deficiency as a major, previously unrecognized, nutritional constraint for upland rice in LAC acid savannah soils; it reduces yields by 50% and greatly increases susceptibility to neck blast and grain discolouration.

2.4.3. Future Strategy

CIAT's role in rice research is regional. To discharge its responsibilities, the centre will continue to exploit synergies with other IARCs, NARS and NGOs. During the next five to six years, CIAT proposes to provide core funds for strategic and applied research in three major areas of upland rice: upland rice improvement; reducing losses due to diseases, arthropod pests and weeds; and integrating rice into three agroecosystems (tropical savannas, forest margins, and hillsides). While proposing to devolve irrigated rice research to FLAR, CIAT has accepted the necessity for its continued but limited participation. Consequently, CIAT is requesting the CG to reinstate, in the 1996 core funding, the position of a socioeconomist who would catalyze and provide research inputs into FLAR's agenda.

CIAT's upland rice strategy is to develop germplasm as an ecosystem management component. Upland gene pools and a diversified genetic base will be achieved through recurrent selection and provision of improved populations to NARS. CIAT also has a comparative advantage in addressing other medium- to long-term issues such as the genetics and physiological mechanisms of tolerance/resistance to biotic and abiotic stresses under acid soil conditions. Thus, the RP will elucidate soil acidity and nutrient constraints; screen germplasm for adaptation to these environments; and determine underlying

mechanisms and plant-type implications for such adaptations, including those for intercropping.

To contribute to regional effort for reducing losses due to biotic constraints, CIAT will focus on durable resistance to blast, diversified resistance to *Tagosodes*/RHBV, and traits that enhance weed control. CIAT will collaborate with IRRI and US universities in the application of biotechnology in the characterization of the blast pathogen, resistance to blast, and resistance breeding.

A study of the inheritance of resistance to RHBV in the newly identified sources, and the crossability of the latter to LAC-adapted materials will facilitate pyramiding of complementary resistance mechanisms. CIAT will also develop gene constructs for rice transformation with viral coat protein (to inhibit viral replication in rice) and antisense genes (to inhibit virus transmission). The RP will intensify studies of traits that reduce damage by weeds: enhanced competitiveness and allelopathy against weeds, and tolerance of water seeding and submergence. It will continue to develop IPM/ICM components to reduce rice pesticide use and production costs through its strategic research on rice pests and on development of nutrient-efficient materials.

As part of IRRI's Global INGER, CIAT will attempt to develop financial support for the conduct of INGER-LAC.

2.4.4. Overview and Assessment

Irrigated rice has been CIAT's most successful programme. The remarkable collaboration between IRRI, CIAT and national systems has had a tremendous impact in Latin America over the last quarter century. In Colombia, for instance, yields have been quintupled and the country has become self-sufficient in rice. The internal rate of return on CIAT's rice programme is calculated at 69%. Rice is mostly grown by large farmers, and consumed by the poor. The decision of CIAT to eliminate its work on irrigated rice in the face of financial problems was taken in the spirit of a mission successfully accomplished.

The move out of irrigated rice was made rather suddenly, and created hard feelings in some quarters. Nevertheless the Panel feels it was a right decision, and once it was made the transition was handled well. The Panel applauds the way in which CIAT has worked to develop FLAR, described above as an innovative and appropriate formula for working with NARS and the private sector. The establishment of FLAR, and hopefully of a similar body for the Caribbean and Central America, leaves CIAT with some residual responsibilities as the administering agency, but without a need to devote core funding to biological research on irrigated rice. The Centre must, however, retain a modest level of in-house expertise if it is to help FLAR to become operational in the next few years, and ensure coverage of the needs of those tropical rice-growing countries in Central America and the Caribbean which require finished lines rather than segregating populations.

A continuing CIAT role as a promoter (rather than as a conductor) of research is particularly important as IRRI breaks through the yield ceiling on irrigated rice and introduces a range of new plant types. These will require adaptation to the LAC environment, in particular for direct seeding.

In the meantime, the Panel endorses CIAT's decision to continue its work on upland rice. Latin America still has ample land in which rice could be grown, particularly in the savannahs with acid soils. Cultivation of these lands does, however, create problems of sustainability. There is a clear need to integrate rice production into well-designed production systems. The research agenda on upland rice is complex, but well suited to CIAT with its NRM programmes. The Centre can play a strategic role, working in collaboration with IRRI, WARDA and CIRAD. Downstream, it cooperates closely with NARS such as Brazil, Colombia and Bolivia. The Panel finds that CIAT's research programme on upland rice is well conceived, the constraints have been carefully analyzed, and the research methodology for addressing them goes in the right direction. The work on rice blast is strategic in nature, and holds out great promise not only for Latin America but perhaps also for Africa.

The Rice Programme as a whole is now the smallest of all CIAT programmes, with only 3.7 SYs budgeted for 1995. The Panel has considered the possibility for CIAT to abolish rice completely as a separate programme, but does not feel this would be wise in present circumstances. Because of the crop's important role in the region there is a strong case for a continued strategic involvement in rice by CIAT. The Centre also needs to keep a high profile in the negotiations surrounding FLAR and a possible sister organization for the Caribbean and Central America. With some residual activities related to FLAR, and a promising research agenda for upland rice, there is a strong case for maintaining a rice programme with a single leader. This will ensure rational management in rice, keep up credibility with donors and NARS, and boost the morale of the programme scientists.

2.5. Tropical Forages

2.5.1. Evolution

The Tropical Forages Programme (TFP) originated from the former Tropical Pastures Programme (TPP), and became operational in 1992. It contains components on Genetic Resources and Plant Improvement and Utilization from the old Tropical Pastures Programme. That Programme's components dealing with Ecophysiology, Nutrient Cycling, Farming Systems and Economics were transferred to the Savannahs Programme (now the Tropical Lowlands Programme). The new TFP has a staff of nine senior scientists.

The new TFP has a world mandate and is focused on the development of improved forage germplasm for agroecosystems with acid soils in the humid and subhumid tropics. This task involves the delivery of selected ecotypes to NARS in Tropical America,

South East Asia and West Africa, as well as to the Natural Resources Programmes in CIAT. Close collaboration with these clients is essential in order to test new germplasms in the different production systems and to develop and investigate management strategies.

The specific objectives of the three areas of the TFP are:

Forage Diversity:

- a) To acquire, characterize, conserve, document and distribute forage germplasm, rhizobia and mycorrhizae for evaluation for environmental adaptation on acid infertile soils of the humid and subhumid tropics.
- b) To identify forage ecotypes adapted to climate and soil, and resistant to pests and diseases, for the humid and subhumid tropics, with persistence, high quality feed value and the potential for soil improvement.

Forage Improvement:

- a) To improve the utility and productivity of *Brachiaria* forage grasses through the use of natural genetic resources complemented by genetic manipulation.
- b) To broaden the range of adaptation of forage *Arachis* species by increasing the available genetic base, to improve agronomic utility and to facilitate *in situ* conservation through population biology studies.
- c) To develop genepools of *Stylosanthes guianensis* and *S. capitata* with durable resistance to anthracnose and high persistence under grazing.
- d) To develop *Centrosema brasilianum* with resistance to foliar blight while maintaining high seed yield and other agronomic characteristics.

Forage Adaptation and Use:

- a) To assess the quality and feed value of forage genetic resources for infertile acid soils in the humid and subhumid tropics.
- b) To identify attributes that confer tolerance to infertile soils and contribute to efficient acquisition and use of nutrients.
- c) To develop and evaluate the productivity, and environmental and socioeconomic impact, of forage components for different production systems.

- d) To facilitate interaction with national organizations, develop effective channels for disseminating information and provide non-degree training.

Because of resource limitations, interaction with the NARS and other research institutions has to some extent been curtailed. This, together with changes within participating NARS, has severely affected the functioning of the Red Internacional de Pasturas Tropicales (RIEPT) network in the past period. Other networks in Central America, Latin America and South East Asia operate well.

2.5.2. Achievements and Impact

Forage Diversity

The TFP made progress with the evaluation of collections of rhizobia and forage species in close collaboration with the Genetic Resources Unit (GRU). To manage the whole forage species collection properly they established a new database. The TFP has published several catalogues of the existing tropical forages collections, which are maintained in the GRU.

In the genera *Arachis*, *Calopogonium*, *Leucaena*, *Panicum* and *Paspalum*, the evaluation of forage accessions resulted in the selection of new promising ecotypes. They are at present being evaluated as components of pasture production systems in different countries of LAC. Collaborating with the Cassava Programme the TFP has selected some legumes and grass species as soil covers for the control of erosion. Evaluation of accessions of legumes and grasses in South East Asia and in West Africa resulted in the selection of germplasm highly suitable for those areas. The TFP has distributed germplasm to 55 countries outside Colombia.

Forage Improvement

The TFP has made progress in the mapping of the apomixis locus. The identification of the nature of the leafcutter pest and of resistance to it permitted the development of a rapid screening method for resistance. In *Brachiaria*, the Programme progressed in work on resistance to spittlebug and foliar blight, plant establishment, and the use of fertiliser. The TFP improved seed quality in *A. pintoii* conservation and made progress among *Stylosanthes spp* in evaluating and characterizing *S. guianensis* and *S. capitata*, and in using natural resistance to anthracnose. For *Centrosema spp* the TFP developed a reliable inoculation method for screening of resistance to foliar blight.

Forages Adaptation and Utilization

The TFP made progress in research on the way tannins affect forage quality, how forage species respond to acid soils in nutrient partitioning, and in the development of grass-legume pastures for forage and as soil covers with a stable and high production.

Networks and Training

Communication with NARS, NGOs and IARCs was mainly through various networks in Latin America and South East Asia. The journal 'Pasturas Tropicales' remained an important means of reporting on tropical forage research in Latin America. In the last five years CIAT organised several workshops, conferences and training activities in LAC and South Asia.

Impact

Impact can be clearly identified in: the release of improved varieties, germplasm for breeding in tropical America, scientific publications, the training of scientific personnel of NARS and NGOs, and on-farm participation in forage evaluation experiments.

2.5.3. Future Strategy

At the same time that the Programme was undergoing significant modifications in its structure and functions, important changes were occurring in the economic framework of many tropical countries, especially in Latin America. The new economic situation and the increase in public investments on road infrastructure in some countries (especially Brazil and Colombia), significantly raised land values and thus the need to improve land yields, which in turn created a demand for more intensive but sustainable technologies. So improved pastures are in greater demand and published forecasts predict a yearly trade of 180,000 kg of forage seeds for the year 2000 with a total estimated value of US\$ 1800 million.

The TFP will give more emphasis to improving the grass species *Brachiaria* and the legumes *Arachis*, *Stylosanthes* and *Centrosema* in particular. A change towards more strategic research is foreseen. Main components will be: increasing and evaluating collections; developing and using host-plant resistance mechanisms; using biotechnological techniques to increase knowledge of genetic diversity and to fine-map the apomixis locus for indirect selection; increasing seed yield and seedling vigour in *Stylosanthes*; adapting to environmental stress by farmer participation and the knowledge of what influences anti-nutritional factors in forages; and networking.

2.5.4. Overview and Assessment

The Panel recognizes the considerable task faced by the Tropical Forages Programme during the last two years in establishing itself as a global germplasm development programme within the new organizational structure of CIAT. Significant managerial abilities have been deployed in building up the programme and in developing efficient channels of communication with NARS and with the other programmes and research units of CIAT. From this process has emerged a scientific staff fully dedicated to collaboration in the improvement of tropical production systems.

The Programme has focused well on priority problems and has responded effectively to the demand of both external and internal clients for forage germplasm adapted to more fertile soil conditions and the use of purchased inputs. The Panel commends the Tropical Forages Programme for its efforts in its first two years, and endorses its initiatives in the CGIAR Systemwide Livestock Programme.

The problems of low yields of viable seed in tropical forages are of critical importance. CIAT has an outstanding comparative advantage in advanced genetic and biotechnological tools. The Panel therefore puts forward the following recommendation:

2. The Panel recommends that CIAT undertake genetic and ecophysiological research to increase both yield and viability of the seeds of the most important tropical grasses and legumes.

The Panel also encourages the Tropical Forages Programme:

- a) To pursue the evaluation of legumes and grasses from South East Asia and West Africa, and to reinforce networking through SEAFRAD;
- b) To maintain support for RIEPT given the outstanding results obtained;
- c) To create an Editorial Board for "Pasturas Tropicales" including experienced outside research scientists;
- d) To interact directly with universities and appropriate private organizations as well as with NARS;
- e) To increase the participation of graduate students from developing and developed countries in its research projects.

Given its potential importance for the Tropical Forages Programme, the Panel suggests that close contact be maintained with the private seed production sector. As questions of intellectual property governing plant materials are resolved in Latin America, and a legal framework is established, rapid changes are likely to occur in the industry. These can be expected to have a favourable impact on germplasm testing, multiplication and demand. If the private sector does indeed expand its activities rapidly, the TFP should consider restricting its forage evaluation procedures to the initial steps of exploration and germplasm screening. At that point the later stages of improvement can be done more effectively by the seed companies.

2.6. Cross Commodity Issues

There are several common themes running through some or all the commodity programmes, notably with regard to germplasm collection, its use in overcoming biotic and abiotic constraints, and its dissemination to farmers through NARS. In all these areas CIAT has made significant contributions but its job is far from over. The observations which follow are additional to those given in Chapter 4.1.1 dealing specifically with the GRU.

Genetic diversity

Links between the GRU and the commodity programmes have been strengthened by appointments in the programmes of germplasm characterization specialists. The use of GIS to help focus future collection activity and identify locales for *in situ* preservation, will need to be coupled with an increased input into the basic taxonomy of the crops and their wild relatives, and ways to introgress genes from wild species into crop gene pools. The use of molecular markers and QTLs to help classify the genetic variation in the collections will enable a more efficient use of CIAT's unique germplasm collection. For cassava, compiling germplasm passport information at the location where the collection was made may increase efficiency. This enhanced GRU-Programme interaction on genetic resources places CIAT in a good position to respond to global and regional biodiversity initiatives.

The backlog in the GRU screening and classifying of germplasm and the lack of an inventory indicating how materials are stored, how viable they are, and how duplicates are recognized remains an issue. For the wild relatives of beans and cassava and many forage species, this is of particular concern because they may not flower at CIAT, giving increasing importance to development of *in situ* conservation or locus of origin efforts. These and related issues will be addressed by an internal review by CIAT's Genetic Diversity SRG, which will be complemented by a CG Systemwide Review of Genebanks in 1995.

The storage and viability of propagules is a common concern, but particularly for forages, cassava and beans. For cassava, cryopreservation promises to reduce the need for maintenance by field grow-outs, enabling allocation of GRU resources to other activities. For forage species too little is yet known of the seed viability in the collection.

All programmes have embraced the opportunities offered by the newly emerging techniques in biotechnology and molecular genetics in a productive and balanced manner. The linkage between Units and the Programmes has been both stimulating and fruitful in this area. The Cassava BTN and Bean BARN are proving excellent vehicles for involving NARS (including universities) and institutions from developed countries in collaborative work in this area. The increasing use of CIAT's facilities and materials for post-graduate training is a positive development which the Panel endorses.

Technology Transfer

Collaborative networks involving CIAT and NARS are the main route by which CIAT is channelling its outputs, and all programmes have been productive in fostering and supporting these. NARS and CIAT are working together to develop participatory planning by objectives, in developing on-farm and farmer-involved selection and multiplication of seeds. There is a commendable recognition by the programmes of the importance of socioeconomic factors in technology adoption. The commodity and NRM programmes are working closely together in the evaluation of cultivars and crop management approaches on farm.

Commercial Involvement in Seed Production and Product Use

Except for irrigated rice, a major limitation to the adoption of new germplasm materials emanating from CIAT's and related NARS research is the lack of commercial demand for quality seed. This should be the driving force in the development of commercial seed production either by private or by government concerns. This may be because the end users of improved seed are mainly small farmers who traditionally produce their own planting material. Limited farmer awareness of the potential gains from using improved varieties is another element. The lack of appropriate legal instruments to protect variety rights in many tropical countries is a further factor inhibiting commercial activity.

For cassava, adoption of virus free, superior planting material will remain farmer-driven because of the small multiplication rate of 10-12 times and the difficulty in producing seed. Another alternative is the development of a micropropagation cottage industry for cassava as has occurred for potato in parts of South East Asia. The NARS will play a large role in this, with CIAT helping in the socioeconomic aspects of how to stimulate farmer and community demands for new technology. CIAT has given due recognition to the role of women farmers in this development.

The Panel suggests that CIAT continue to document in easily accessible form its experience in the production of seeds and propagules of its mandate crops. CIAT should also promote the production of improved seed and seek to ensure that appropriate advice is available for seed producers.

Product Diversification

For cassava there is much potential to stimulate industrial use, particularly of cassava starch for food products. Based on the commendable achievements from CIAT's collaboration with CIRAD, NRI, Colombia, Brazil and Ecuador in this area, the Centre could play a role by assembling information, and stimulating and coordinating research, on potential industrial uses, as any benefits from the increase in demand for cassava will flow on to producers.

CHAPTER 3 - NATURAL RESOURCES MANAGEMENT RESEARCH

3.1. Introduction

The past work of CGIAR centres has already made major contributions towards increasing the food supply of certain crops and alleviating poverty in the developing world. But it has become increasingly apparent that there are pressing needs for improved management of natural resources to ensure the sustainability of agricultural productivity. For example, cereal monocropping in the savannahs leads to a rapid linear fall in yields as organic matter declines. In the hillsides, soil erosion undermines agricultural productivity and the livelihood of poor farmers.

Moreover, agricultural activities also often have important environmental consequences going beyond agriculture. For example, continued clearing of natural vegetation for new farming and grazing land in the lowland forest margins, savannahs and hillsides threatens a massive loss of biodiversity. Erosion and deforestation in hillside watersheds can have a major negative effect on downstream water resources. On the other hand, intensified pasture systems in the savannahs can have a beneficial effect by acting as a carbon sink, thus reducing the risk of global warming.

Responding to the need for more sustainable agriculture, while simultaneously preserving the natural resource base, the CGIAR is searching for an approach to address these issues through the IARCs acting in collaboration with other organizations. CIAT is at the frontier in this search.

In 1990, TAC defined the warm humid tropics as the highest priority for research in the Americas. CIAT, considering the heterogeneity of this ecozone, conducted a study to prioritize agroecosystems in tropical America. The variables included: climate, soil, land use and potential for alleviating rural poverty. Three priority areas emerged from this study: 30 million ha of hillsides, 180 million ha of savannahs, and 45 million ha of cleared forest margins. These agroecosystems share the common problem of acid, infertile soils; they are well-watered; and pasture is the main land use. They are also linked socioeconomically; for example, most migrants to forest margins or savannahs seek better living standards than they can find in the hillsides.

The strategy defined for natural resource management is to integrate regional land use and farming options that help relieve market and social pressures on fragile environments. The work includes two levels of aggregation. The first is at the sectoral and regional level, with emphasis on the understanding of policies to mobilize alternative land use strategies. The second is at production level, with the emphasis on generating and integrating improved technologies into economically viable systems which are also agroecologically sound and efficient in the use of inputs. This general strategy includes three

elements: understanding the natural resource processes; generating new technology, including adapted germplasm; developing decision tools and policy options to promote sustainable development.

This common approach, adapted to the features of each agroecosystem, has been initiated in each of CIAT's three ecoregions. The time so far elapsed is short, but the first results justify a certain optimism.

Initially, four programmes were created: Land Use, Hillsides, Savannahs and Forest Margins. At the time of the Review there are two programmes, Hillsides and Lowlands, and two SRGs: Land Management, evolved from the former Land Use Programme; and Production Systems and Soil Management.

3.2. Hillsides

3.2.1. Evolution

This Programme builds on previous work in the Bean and Cassava Programmes and the Participatory Research Project. It has its origin in a working group formed during the development of CIAT's Strategic Plan in 1991. At that time, the Agroecological Unit identified a subsystem of Tropical American Hillsides (30 million ha out of the 96 million ha in the whole region) that have acid, low-fertility soils and are well-watered, like the savannahs and forest margins of the tropical lowlands. That subsystem has an important rural population, and is undergoing serious environmental damage from loss of biodiversity, erosion, nutrient losses and water contamination.

CIAT, IICA, CIMMYT and CATIE formed an International Hillsides Consortium in 1991. A Central American NGO and IFPRI joined the group. After a rapid rural appraisal, the group selected La Ceiba, Honduras, as a research area and identified broad priorities.

By 1994, the group had established the Andean Hillside inter-programme activity in the Cauca Valley, Colombia, with two scientists from the Lowlands Programme allocating 20% of their time to this site.

In both areas, the selection of specific research sites aimed at incorporating a large degree of variability across a range of conditions, reflecting the diversity of the hillsides as a whole. Thus the Central American project, with three sites, covers a significant range of annual precipitation. The Cauca, in the Colombian Andes, has a wide range of hillside systems including slash and burn, high-input horticulture, and cultivation of CIAT commodities (beans, cassava, forages). In each case the watershed is the area under study.

In both areas the rapid rate of environmental degradation is thought to be driven by the lack of incentives for hillside farmers to invest in conservation. The three objectives of the Programme are: to characterize the mechanisms leading to resource degradation and assess technological options; to generate agroecologically and economically viable components, acceptable to farmers, for soil and water conservation practices; and to strengthen the capacity of national systems to generate and transfer resource-enhancing technologies. The programme follows the operational structure for NRM defined in CIAT's 1993-98 Medium-Term Plan, including a 'vertical' element or in-depth case studies conducted by area-based teams, and a 'horizontal' component of comparative research led by the headquarters team.

The Programme consulted partner institutions, then selected specific priorities for the sites in Honduras and Colombia. Points held in common were: the search for conservation practices; their effects on regeneration; strategies to increase technological components and their adoption; the economic value of conservation practices; and the distribution of benefits in the community.

To complement the consultation the headquarters scientific staff analyzed and prioritized the strategic research issues. Those identified as relevant to the Programme's capacity are:

- To improve methods for extrapolation and targeting of technical soil conservation recommendations. This will be possible after a clearer relation has been established between practices and productivity, and a set of guiding principles to select suitable practices has been developed.
- To develop decision-support systems for land use planning and technology design. Management of natural resources in hillsides requires collective action, and this involves reaching a consensus on the cost of solutions. A decision support system which is multi-objective and multi-stakeholder will help greatly.
- To generate technologies that serve production or income as well as conservation needs. Existing technologies have to be tested in transition systems before generalizations can be made about their effects on conservation and production, especially in the more closely integrated agrosilvopastoral systems.
- To develop methods for participatory research and development with a view to accelerating the adoption of conservation practices, especially through identifying institutional mechanisms, goal-formulating capacities and a good interface between farmers and researchers.

In relation to staff, the target level in the Strategic Plan was never reached. In 1994, 5.6 Senior Staff positions were budgeted, 4 were approved but at present there are only 3.6 effectively available.

3.2.2. Achievements and Impact

The impact of NRM research comes inevitably over the longer term. In its first three years of activity at three sites, the Hillside Programme has carried out careful problem identification and prioritization, and has initiated four research projects with interesting first results. Prototype systems have been designed, field trials have been planted, and the Decision Support Research group has calibrated five different models. Conservation technologies have been tested through participatory research.

To illustrate the importance of the last point, researchers tested several conservation technologies and made a provisional selection based on their effectiveness in controlling erosion. However, farmers selected others on the basis of complementing their animal production. So practices had to serve both production and conservation simultaneously (win-win technologies).

The Programme established institutional relations through consortia. The International Hillside Consortium for Central America and a Colombian Consortium (CIPASLA) with ICA and an NGO were formed; and the programme joined the Andean Ecoregion Consortium (CONDESAN) for collaboration with CIP. In programme development, three senior scientists were outposted to Central America, and special funds (US\$ 2.2 million) were obtained for Central America and the Andean region.

3.2.3. Future Strategy

Because the hillside agroecosystem is so diverse, it is impossible to develop a single technology package or policy for universal adoption. So the strategy of the Hillside Programme for the next five years is to develop a methodological tool kit for national agricultural and NRM institutes, and for other clients, offering:

- a) A land classification scheme to identify and select 'strategic' watersheds, that is, with significant downstream user constituents for improved resource management;
- b) Bioeconomic models for *ex-ante* impact assessment and methods for the economic evaluation of conservation technologies;
- c) Improved methodologies for soil quality assessment and indicators of sustainability to facilitate extrapolation of results and targeting of conservation practices;

- d) A suite of calibrated models to use in a decision support system tailored to the requirements of multiple stakeholders who collectively manage common resources;
- e) Methodologies and organizational principles which can be widely disseminated among diverse clients;
- f) Guidelines for combining component technologies into transitional production systems.

More specifically, future strategy will involve completing the Hillside projects started in 1993/94. These are: 'Effects of soil degradation and practices for soil conservation and regeneration on the potential productivity of cultivated hillsides'; 'Decision Support Systems for Land Use Planning, Technology design and Participatory Research'; 'Prototype systems for ecologically sound intensification of production in the hillsides'; and 'Improving Agricultural sustainability and livelihoods in the hillsides'. These projects are being implemented in stages, first at the Andean site, then in Central America.

Among new projects there is one funded by the Kellogg Foundation (US\$ 750.000 in 3 years), 'Dissemination of a model for community-based, participatory, agricultural technology development'. Other new projects concern: biodiversity and *in-situ* conservation in the tropical American hillsides, together with the CIAT Biotechnology Unit, IPGRI and potentially CONDESAN/CIP; and 'Application of integrated market and production of high value production system component for the hillsides', together with the Cassava Programme.

3.2.4 Overview and Assessment

The Panel considers that this Programme is at the cutting edge of integrated research for agroecosystems involving smallholder communities. Many innovative methods have been adopted, particularly for achieving farmer and community participation, that will benefit the sites, the ecoregion, and the overall development of effective approaches to research in natural resource management in the small farm sector.

The results obtained in collaboration with other Programmes and Scientific Groups in the area of selection and characterization of sites is encouraging. In the area of conservation technologies and their adoption by farmer communities there are important methodological findings and practical results.

The strategies and methods proposed are comprehensive and challenging. Some are also ambitious, particularly the build up of Decision Support Systems, considering the present resources available to the programme. Decision Support for the Hillside system would involve models of the basic processes related to soil, weather and crops at the farm, community and watershed levels. Some needs can be met using available models; in other

cases models have to be adapted or even created. Careful consideration should be given to the time and effort required to validate existing models and the adoption and generation of new ones. More expertise is needed at CIAT in the area of models, expert systems or Decision Support Systems. A recommendation on this issue is made in section 4.3.1.4.

Even though the staff is very capable and motivated, the pending loss of the Programme Leader and another core scientist raises in acute form the issue of critical mass. The Panel urges that consideration be given to concentrating the limited staff in one site, selecting the site that appears more promising in terms of an integrated approach, possibilities of obtaining early results, and a wide community impact.

International and national collaborators are already involved. The Panel encourages the Programme to look for regional partners, like PROCIANDINO (IICA), that have an interest in activities in the Andean Hillsides related to land degradation. These interests may complement the activities of CIAT. Well chosen partners can help in consolidating and focusing the Programme's research.

3.3. Tropical Lowlands

3.3.1. Evolution

The origin of this Programme - which was formally created in 1993 by merging existing programmes on the Savannahs and the Forest Margins - goes back to 1989. At that time the Rice and Tropical Pastures Programmes, together with the Colombian NARS (ICA) and the Federation of Rice Growers (FEDEARROZ), began a research project in the Colombian savannahs to integrate experimental lines of rice into cropping systems with pasture grasses and legumes.

In 1991, CIAT created a Working Group on Savannahs jointly with EMBRAPA's Centre for Agricultural Research in the Cerrados (CPAC) of Brazil. This group began a study of the Brazilian Savannahs using secondary information on environmental classes, farming systems, land use and rural census, all integrated into a Geographical Information System (GIS). As a result, an area was selected for future research in the Brazilian Cerrados.

During 1991-92, CIAT began a feasibility study of rice-pasture systems using Delphi surveys and Rapid Rural Appraisals in both the Brazilian and Colombian savannahs. Also at that time, CIAT contracted with a Brazilian NGO to conduct a socioeconomic study of land use in the Brazilian savannahs and forest margins. In early 1993, the Forest Margins programme integrated its activities with the CGIAR Alternatives to Slash and Burn initiative led by ICRAF. CIAT is the regional coordinator for LAC. Research involving CIAT, ICRAF and EMBRAPA is underway in Brazil, on a strip of land along the Acre-Rondonia border.

Because of limited resources, the existing activities in the Savannahs and Forest Margins were merged to create the Tropical Lowlands Programme in late 1993.

The overall objective of the Programme is to: 'develop and adapt technologies for sustainable production systems for the acid soil savannahs and forest margins of tropical America while reducing the pressure for environmental degradation by maintaining or enhancing the quality of the natural resource base'.

The staff level budgeted in the Strategic Plan has not been reached, and at present there are nine Senior Scientists and three Postdoctoral Fellows.

For both Savannahs and Forest Margins, there are three inter-related research areas:

1. Agroecological characterization through an analysis of trends in land use patterns;
2. Studies of the production, resource conservation and socioeconomic circumstances of current patterns of land use;
3. Development of sustainable agropastoral and agrosilvopastoral prototype systems, based on biophysical and socioeconomic processes that affect resource management.

3.3.2. Achievements and Impact

In work on agroecological characterization between 1991 and 1993, CIAT integrated farming systems, environmental, and other socioeconomic information in a GIS and concluded by selecting research areas in Uberlandia for the Brazilian savannahs, the Meta region for Colombian savannahs, and Acre/Rondonia for forest margins.

In the field of studies on production systems, six projects have been formulated, including a characterization of the existing farming systems, allowing an impact assessment of contrasting management systems on the natural resources; and cross-sectional studies (replicated over space and time) providing estimates of temporal trends. These studies have started in the Meta and Uberlandia. Also in this field there has been on-farm and participatory research with monitoring of inputs and outputs at farm level. These studies have achieved several objectives, among which are the rehabilitation of degraded pastures by introducing crops and legumes, and ascertaining the positive effects of a succession crop after a combination of grasses-legumes.

In the Forest Margins area, in the two sites of P. Peixoto (Acre) and Theobroma (Rondonia), characterization has advanced and the initial experiments are just starting.

The development of sustainable prototype systems is being implemented through seven projects involving long-term strategic research in the savannahs of Colombia (Carimagua) and Brazil (Brasilia, CPAC) to quantify the soil-plant processes associated with changes in primary biomass productivity. These experiments are carried out in collaboration with the respective national programmes (CORPOICA and EMBRAPA). They are long-term experiments on present and potential crop rotation and ley-farming systems. They involve a detailed characterization of the crops and soils to understand processes, derive sustainability indicators, and develop or validate models representing technological systems or components. These can later be used to explore scenarios of sustainable production systems.

In Brazil, after three years of experimentation, there are conclusions about soil factors affecting crop performance and that of pasture and animal productivity. In Carimagua (Colombia) the CULTI-CORE experiments established in 1992, exploring several alternative systems, have concluded and emphasized the positive effects of rice established with pastures, especially when legumes are also incorporated. In both cases, soil compaction and nutrient depletion, as important sustainability factors, are correlated with changes in soil fauna populations.

Besides the long-term experiments, there is on-farm validation of components and some combinations, and transfer activities like the crop-pasture technology that is being monitored on 44 farms in Colombia. Between 1992 and 1993 there was a 44% increase in areas sown to rice-pasture and a 34% decrease in areas sown to monocropped rice.

Other forms of process-oriented research have produced interesting results related to organic matter decomposition in these acid soils, and the positive effects of introduced grasses, especially when combined with legumes to sequester significant amounts of soil carbon, a phenomenon which could potentially be of global importance.

Other impacts of the programme are the fostering of greater interinstitutional linkages via research projects such as: the global 'Alternatives to Slash and Burn' project in the forest margins (led by ICRAF globally and by CIAT regionally); an agropastoral network with Bolivia, Brazil, Colombia and Venezuela; Consortia, such as the Management of Acid Soils (MAS), and a recent ecoregional consortium on the use and management of savannahs with PROCITROPICO/IICA, FAO, CIRAD, and the national institutes IBTA, EMBRAPA, CORPOICA AND FONAIAP.

In December 1994, CIAT and IBSRAM were designated conveners of the Soil, Water and Nutrient Management (SWNM) global initiative. CIAT is coordinating the general proposals for TAC, and specifically that on acid soils in Latin America.

3.3.3. Future Strategy

The Programme will continue emphasising its three major research regions: the Brazilian Cerrados, the Colombian Savannas and the Forest Margins. It will also complete the three inter-related areas of research in each region, especially the development of sustainable agrosilvopastoral systems which is in its initial stage.

As part of the scientific research group on production systems and soil management, and of the MAS consortium, new thrusts will be pursued on C sequestration, P acquisition and the integration of organic and inorganic nutrients in lowland systems.

As convener of the SWNM initiative, CIAT plans to identify several projects and international and national partners in order to consolidate research on the ecoregions selected.

3.3.4. Overview and Assessment

Even though the Programme was inaugurated in late 1993, there are several important achievements from the Savannas and Forest Margins activities which started earlier and which have continued in this programme.

The Panel finds that there are important contributions to methodology as well as direct impacts from programme-developed technologies. The selection of geographical areas for research, the cross-sectional land use effects on natural resources, the long-term research on scenarios of farming systems, their components and the differential effects on land use and natural resources, the search for indices of sustainability, are all innovative contributions. The important agropastoral system technologies (Rice-Grass-Legumes) are having a significant impact in the region. NARS and private organizations are transferring and adopting these systems.

The Panel suggests that the long-term experiments in Brazil, as well as in Colombia, could benefit from an even more comprehensive approach by incorporating scientists from CIAT or other institutions to cover other important components like crop phenology, the dynamics of organic matter, and expertise in the area of simulation models, expert systems, or Decision Support Systems. The build up of Decision Support for the Tropical Lowlands would include the validation and development of models derived from the experiments in relation to soils, crop and management processes; the capacity to structure crop and farming system prototypes for an *ex-ante* impact assessment of sustainability; policy-later evaluation of components at farm level; and finally the process of farmer and policy decision-making. Limitations in human and financial resources suggest that an important decision has to be made in relation to the number of sites for the savannas and the forest margins. The Panel urges consolidation in one site for each agroecosystem in order to promote the more efficient and effective use of available resources.

In relation to the Forest Margins activities in Brazil, the Panel considers that it is important to clarify the coordination and programmatic boundaries with ICRAF and EMBRAPA, and the internal coordination within CIAT. Clearer responsibilities and reporting lines are needed within and across the institutions involved. As LAC convenor for CGIAR ecoregional initiatives CIAT has an important role to play here. The general definitions and principles for the governance and management of system-wide programmes and ecoregional initiatives agreed last December at IPGRI are an important guide for this purpose.

3.4. Land Management Group

3.4.1. Evolution

Since 1989, the evolution of this Group has been from the Agroecological Studies Unit (until 1991), to the Land Use Programme (until February 1994), and finally to the Land Management SRG. This last decision responded to CIAT's financial difficulties.

From the start, the Group had a system perspective focusing on working in partnership with other CIAT groups, on identifying new geographic areas of researchable problems, on the extrapolation of research results, and on policy oriented research. Additionally, in the last few years, it has generated its own projects broadening its scope from the biophysical to the socioeconomic area and to policy analysis. This is aimed at understanding and anticipating land use changes in tropical America, the determinants and impacts of land management, and their implications for technology development and diffusion. All this requires the causal analysis of trends in land use, the study of the spatial distribution of agricultural land use patterns in relation to ecological factors, understanding the role of cross-scale (micro/macro) interactions in land use dynamics, and the identification and development of policy-relevant indicators of sustainable land use.

In 1994, it became a member of the Committee 'Use of GIS in Agricultural Research Management', together with UNEP, as part of a CGIAR initiative on GIS. It also became a UNEP collaborating 'Centre for Environmental Assessment' for Latin America and the Caribbean.

The main tools of the Group have been databases related to biophysical aspects, like climate, soil and physiography, but lately more emphasis has been on agricultural statistics, land use and other socioeconomic aspects. These databases are being processed through a Geographical Information System (GIS) and global simulation models by a group of four experts at present.

3.4.2. Achievements and Impact

This group is well recognized in CIAT for its collaboration and achievements. In this period we can cite:

- A diagnosis of Latin American rice distribution; an Atlas of Cassava for Africa with IITA; maize distribution in the Andes with CIMMYT; land degradation in the Peruvian Amazon with IFPRI; and land use in the high Andes with CIP. In all cases this activity helped priority setting for research.
- Selection of the most important agroecosystems in Latin America and the Caribbean. Within the agroecosystems, sites were selected and characterized, namely hillsides in Honduras and Colombia (Colombia), one savannah site, two forest margins in Brazil, and a land use study in Acre/Rondonia.
- Several applications have been made to biodiversity with GIS and environmental classifications, like the mapping of the bean core collection, and the environment of wild relatives of crops to guide germplasm searches.

3.4.3. Future Strategy

The Group will emphasize both site-specific and ecoregional research. According to its goal on sustainable land use, the investigation of the ecological and economic determinants and impacts of land use will be added to the geographical and anthropological dimensions already incorporated. The Group is planning to complete its minimum core competence by the incorporation of a Tropical Ecologist and a Resource Economist.

In relation to GIS, it will move further in complex GIS analysis integrating crop growth, hydrological and erosion models. Use of simulation models for land use planning will also be integrated into GIS.

Some examples of major initiatives soon to be undertaken are:

Characterization and analysis of land use dynamics in Central American Hillsides; nutrient acquisition and use in the savannahs; carbon sequestration in tropical lowland ecosystems; *in situ* conservation areas of *Arachis* germplasm; resource degradation and land use in Latin America; an integrated spatial database for the Andean regions; and strategies for sustainable land use in the lowland savannahs of South America together with FAO, IICA and regional NARS.

In summary, future research will involve agroecosystem themes, continental projects, biodiversity-related projects, commodity-related activities and theoretical research.

3.4.4. Overview and Assessment

The Panel is pleased to acknowledge the effectiveness of the activities carried out by the Land Management Group, which have led to significant contributions for other programmes, scientific groups of CIAT and other IARCs and the community as a whole. Special mention is made of the GIS team, who have acquired a leadership role in the region as well as among the CGIAR centres. The themes and approaches of this group are filling important gaps and are opening new avenues, especially in the processes of technology transfer at different scales and the very important area of impact of land use policies on the management of natural resources, fields on which they should concentrate.

Many national institutes will benefit from closer associations with the group, such as those proposed in the "Strategies for Sustainable Land Use in the Lowland Savannahs of South America". On the job training and other techniques of transfer will strengthen the national collaborators.

Interactions with somewhat analogous methods of Land Use Studies, like the FAO Framework for Land Evaluation, can be expected to provide benefits in the area of integrating biophysical and socioeconomic studies as well as in the selection of land quality indicators.

The facilities and human resources are very appropriate and continuous support should be given to its maintenance and future development.

The Panel urges a clearer delimitation of the scope of work of the group, and the strengthening of channels of interaction with other SRGs, Units and Programmes, particularly with the Natural Resources Programmes, in order to avoid duplication and to focus on the group's central role.

The SRG is at present an anomaly; contrary to the policy regarding SRGs it has a budget and fixed assets. The Panel urges CIAT to study the implications for the Centre of making the Land Management SRG into a programme or a unit. The decision will depend on the direction that CIAT wants to take in this field. If the Centre wants to emphasize activities at the regional level in Latin America, or perhaps also further afield, and to strengthen work on land use policies and their consequences for land degradation, as well as sustainability indicators within and between ecoregions, then the Land Management would be better as a programme. If CIAT prefers to place main emphasis on the support that this group gives to the Natural Resources and other programmes in matters of GIS, data collection and its analysis, then it would be better to consider it as a unit. There will always be a mixture of both activities, and support to other CIAT programmes must be a top

priority, but the direction in which the group should move must provide the basis for a decision. This matter is taken up again in the recommendation in the next section.

3.5. Conclusions

The Panel agrees with the expansion in natural resources research initiated by CIAT since the last EPMR. The most important contributions in this area are: the selection and characterization of three important agroecosystems for Latin America and the world, where present agricultural practices are associated with significant land degradation effects; the development of a research approach aimed at obtaining, through case studies, knowledge of natural resources, cropping systems and decision-making processes and their links with land use policies; sustainability factors; and a start with the development of a methodological framework or tool kit for NARS to use in their respective countries.

In the face of severely limited human and financial resources, the Panel has suggested above that activities of both the Hillsides and the Lowlands programmes should be concentrated in the minimum necessary number of sites, while retaining as comprehensive an approach as possible. In a later phase the number of sites could be built up in a network approach with the NARS, in order to validate and transfer methodologies.

The Panel has considered various options for the organization of programmes in the Natural Resources Management area, but without reaching any final conclusion. It has therefore decided to submit these options for the new Director General and the Board to consider further. The options identified are:

- a) To leave the present situation unchanged, with the two ecoregional programmes for Hillsides and Tropical Lowlands, but with Land Management becoming either a programme or a unit as outlined in the preceding section;
- b) Forest Margins would be moved from the Lowlands to the Highlands programme, as the two sets of activities have a strong emphasis on socioeconomic factors and deal with similar crops. The Lowlands would continue as a separate programme, with Land Management again becoming either a programme or a unit;
- c) The two ecoregional programmes could be consolidated into one, with Land Management becoming a separate programme or unit;
- d) All activities, including both the ecoregional programmes and Land Management, could be consolidated into a single Natural Resources programme.

The Panel emphasizes (b) and (c) as its preferred options.

The preceding views are summarized in the following recommendations:

3. In view of the limited resources available for CIAT's NRM work, the Panel recommends that:

- the number of research sites be reduced;
- Board and Management consider the options for consolidating existing programme structures (Chapter 3.5);
- the Land Management SRG become either a programme or a unit depending on the orientation that CIAT considers more appropriate to its future (Chapter 3.4).

The Panel draws attention to its recommendation in Chapter 4.3.1.4 regarding the integration of expertise in scientific data management and decision support systems in a broadened Biometry Unit. This is of considerable importance for work on NRM.

In addition, the Panel feels that CIAT should go ahead with the establishment of a Soils Unit as already discussed inside the Centre. The Panel's support for this proposal is based on its understanding that the expertise in soil science necessary within the programmes would not be critically weakened. The Panel feels that CIAT should attempt to mobilize funding for a Soil Biologist to be located in the Soils Unit. The following recommendation is put forward:

4. The Panel recommends that CIAT establish a Soils Unit, which should follow an integrated approach with emphasis on organic matter, soil biota and nutrient cycling. The funding of a Soil Biologist to be located in the Unit should be given a high priority.

The ecoregional consortia already established with NARS, IARCs and regional programmes like the PROCIS of IICA, should be encouraged as they are important vehicles for mobilizing expertise, resources and decision capacity to address the natural resources problems of the region.

CHAPTER 4 - RESEARCH SUPPORT

4.1. Research Units

4.1.1. Genetic Resources Unit

4.1.1.1. Role and Objectives

The GRU is to collect, conserve, evaluate and distribute germplasm resources of *Phaseolus* beans, cassava and tropical forages. This is a labour-intensive long-term activity involving many research fields. The GRU has two main tasks: germplasm management and the provision of services. It has three main clients: 1. CIAT scientists for germplasm development; 2. NARS for national genetic resources programmes, acquisition of germplasm, and both *ex situ* and *in situ* conservation; 3. IPGRI for expeditions, strengthening national programmes and conservation technology.

4.1.1.2. Achievements

In the last five-year period, the GRU started a laboratory for Seed Health and one for Electrophoresis. This resulted in an initial increase of personnel followed by a decrease due to financial reductions. The GRU opened new gene bank facilities (1991), implemented the database on ORACLE software and appointed three curators for the management of beans, cassava and tropical forage collections. The head of the unit moved to IPGRI and had not been replaced at the time of the Review.

Phaseolus beans

Highlights were the new quarantine house in Bogotá, the new high altitude location for high quality seeds, and the assembly of one core collection based on *P. vulgaris* and one on wild species. The GRU added 2,225 new accessions resulting in a total of 27,434 accessions and distributed 16,120 accessions to 42 countries. Problems are the lack of germination facilities, and of routine techniques for identification of duplicates.

Tropical forages

Important achievements were: reorganization of the reference herbarium, taxonomic studies on *Brachiaria* and *Galactia*, and biochemical characterization of *Stylosanthes*, *Centrosema* and *Arachis*. This collection contains 21,000 accessions consisting of 150 genera and 700 species with 90% legumes and 10% grasses. The GRU distributed 16,735 accessions to more than 30 countries. Problems are insufficient knowledge of seed physiology, and lack of a cool room for temporary storage.

Cassava

The world cassava collection was increased by 1,147 accessions during the period to reach a total of 5,491. It is maintained in the *in vitro* bank and in the field. Long-term cryopreservation is being developed (BRU) as are implemented routine techniques for duplicate screening. Isozyme profiles and parameters representing different ecosystems (GIS) are the base of the new core collection (1991). The GRU has indexed a total of 1126 accessions for the main cassava viruses and distributed 1,648 accessions to 34 countries.

In the last five years the GRU trained 33 professionals from 17 countries in germplasm management and carried out two courses.

Future aspects

The Biological Diversity Convention (1992) is stimulating the CGIAR centres and the GRU to play a leading role at world level for bioconservation. The Unit envisages a broader conservation strategy for the genetic resources of the three commodities and technology transfer to the region.

4.1.1.3. Overview and Assessment

In the management of genetic resources many important developments in biotechnology, as well as global concerns about biodiversity, are influencing the functioning of this Genetic Resources Unit and the position of CIAT in this field. This indicates the urgent need of a high level unit manager. Fortunately some of the necessary technical research components, such as the application of marker technology, are being covered by the BRU. Research on the methodology of preserving the viability of stored seeds needs more attention. There is still a lack of a duplicate collection as recommended in the 1989 EPR, and there are no quarantine procedures to permit a two-way intercontinental exchange of cassava.

The Panel puts forward the following recommendation:

5. A new head of the GRU should be appointed as soon as possible. Experience is needed in strategic thinking on genetic resources, as well as in marker technology and the computing aspects of population genetics/dynamics.

A person with these qualifications could also fill important gaps in the BRU and the Biometry Unit.

4.1.2. Biotechnology Research Unit

4.1.2.1. Role and Objectives

The BRU resulted from a recommendation of the second CIAT External Programme Review, 1984. It integrates the application of modern biotechnological methods with existing methods in the programmes. The BRU has a bridging role with CIAT's programmes, unit scientists and the NARS, who are the major clients. The BRU works with all four commodities.

4.1.2.2. Achievements

Genetic diversity: In beans, studies with biochemical/molecular markers showed gene flow between wild forms and (primitive) cultivars. Using the markers together with GIS data, a core collection is being characterized. In cassava, BRU made a significant first step for a linkage map. In *Brachiaria*, the unit developed markers with linkage to the apomixis gene up to 10cM enabling indirect selection in segregating populations. Purdue University provided a repeated DNA probe from the rice blast fungus *Pyricularia grisea*. Fingerprinting using this probe assigns large number of virulent pathotypes into related 'families'. The BRU has developed markers to enable PCR mediated screening for several resistance genes to rice blast.

Plant product-microbe interactions: In sour cassava starch, *Lactobacillus plantarum* isolates are responsible for fermentation. PCR-based techniques permitted detection of the best strains.

Gene transfer: Embryo rescue enabled interspecific crosses between *Phaseolus vulgaris* and *P. acutifolius* to transfer biotic and abiotic stress resistances. Electrophoretic techniques were helpful in monitoring backcrosses. The BRU developed transformation of rice by biolistics using zygotic embryos and panicles. Transformation of *Stylosanthes guianensis* by *Agrobacterium tumefaciens* has already succeeded while that of cassava needs confirmation. There are some genes available for the improvement of resistance or quality traits.

Biosafety: CIAT has an Institutional Biosafety Committee, including a representative of the Colombian Government, which oversees all recombinant DNA research under Board-approved Biosafety Guidelines. CIAT contributes technical input to the development of National Biosafety Guidelines by the Colombian Government. CIAT's policy is to abide strictly to Colombian National Biosafety Guidelines.

Technology transfer: The BRU transferred several *in vitro* (anther culture, preservation) and molecular marker techniques (isozymes, storage proteins, RFLP, and RAPDs) to the users.

Training played a leading role in the past period.

Relationships: BRU formalized collaboration with 12 laboratories in the developed world. There is one Network in cassava (Cassava Biotechnology Network; CBN) and one in *Phaseolus* bean (Beans Advanced Biotechnology Research Network; BARN). They are platforms for contacts and initiation of projects between developed and developing countries. Four conferences were organized under the auspices of the CBN and BARN.

Future aspects

Integration of biotechnology tools and GIS will allow improved analysis of agrobiodiversity for better conservation. Fine mapping of the apomixis gene and QTL mapping of important quantitative traits for indirect selection are important to provide yield improvement breakthrough. Training programmes for LAC scientists will continue to strengthen the capacity of the NARS.

4.1.2.3. Overview and Assessment

In the fields of marker technology and transformation, the BRU has made excellent progress. As a result CIAT has positioned itself prominently in this field, and is able both to exploit the new possibilities of biotechnology in its own research and to develop priorities. It is clear that the development of marker technology is crucial for research on genetic resources and agrobiodiversity, and for the transformation of germplasm. Deficiencies in the necessary theoretical background for the conversion of the collected marker data and the development of new strategies is a limitation. Priority setting in the BRU strikes an appropriate balance between marker technology, transformation and gene cloning. The development of cryopreservation deserves more attention in order to rationalise the conservation of cassava. In the view of the Panel the excellent training in biotechnology needs to stay a top priority.

CIAT has developed several transgenic plants. The Panel puts forward the following recommendations:

- 6. The Panel recommends that CIAT establish more biosafety greenhouse compartments for contained experiments, in line with its own biosafety guidelines.**
- 7. The Panel recommends that CIAT should only undertake field trials with transgenic materials after obtaining approval from the government concerned.**

4.1.3. Virology Research Unit

4.1.3.1. Role and Objectives

The principal objective of CIAT's Virology Research Unit (VRU), established in 1988, is identifying and controlling viruses that affect the productivity and use of the genetic resources of cassava, beans, rice and tropical forages. Specifically it will develop integrated control measures minimizing pesticide abuse in the control of arthropod vectors of viruses and will continue to play a major role in germplasm introduction and distribution by providing efficient phytosanitary service. It will diagnose and characterize viruses, incorporate virus resistance through genetic transformation of susceptible lines, and assist NARS to identify viruses of CIAT's mandate crops.

In executing its programme the VRU collaborates with the NARS, CIAT's commodity programmes, the BRU and GRU of CIAT, other IARCs, regional research centres, and advanced laboratories in the USA and Europe.

4.1.3.2. Achievements

The VRU, staffed by two core-funded virologists, has an impeccable record of achievements. It has some of the best continuously updated virus research facilities in the developing countries.

Phaseolus beans. The Unit collaborated with the Bean Programme to incorporate resistance to BCMV into more than 90% of improved lines and to develop genotypes resistant to whitefly-transmitted geminiviruses. It identified, controlled, and monitored bean viruses of LAC, Asia and Africa, thereby contributing to sustainable bean production.

Cassava. The VRU's work on cassava viruses has established that two disorders (frog-skin and Caribbean mosaic) are caused by the same virus and has developed diagnostic methods for its detection. The VRU has also developed sensitive techniques for detecting cassava viruses in tropical America, and for African and Indian cassava mosaic viruses, thereby facilitating exchange of cassava germplasm. It has identified major cassava viruses in the Americas and developed effective controls for CCMV and FSV.

Rice. With regard to rice viruses, the VRU has identified and characterized the RHBV which has assisted the selection of rice varieties resistant to the virus and its vector.

Forages. The Unit has also detected more than 25 viruses in tropical forages legumes and grasses and developed diagnostic methods for viruses of *Arachis pintoii*, *Centrosema* spp., *Stylosanthes* spp. and *Brachiaria* spp.

4.1.3.3. Future Strategy

In the medium term, the VRU intends to intensify its work on the characterization and control of viruses affecting CIAT's mandate crops. Specifically, it will participate in diversifying resistance to RHBV, characterize bean cucumoviruses and screen the cassava core collection and wild relatives for resistance to FSV. It will participate in the diagnosis, characterization and epidemiology of CVMV with a view to its integrated control. It will also participate in worldwide deployment of ACMV resistance and in the development of simple techniques for forecasting the incidence of BGMV in affected regions of LAC.

4.1.3.4. Overview and Assessment

CIAT's VRU is well equipped. Its contributions to CIAT's commodity improvement efforts and to the world's scientific community have been catalyzed by effective collaboration with CIAT's commodity programmes and advanced laboratories in developed countries. The Panel applauds these contributions.

Implementation of the Unit's MTP is threatened by the recent 30-40% cut in core-funding, although its adverse effects are somewhat ameliorated by special project funding. The Panel urges that efforts be continued to assure the VRU of sufficient, reliable funding and scientific support staff. The Panel notes that the VRU's work on monoclonal antibodies and other molecular techniques has attained such a high level of competence and dependability that the Unit is now empowered to "definitively identify all whitefly-transmitted viruses". Given the CG systemwide utility of this technology, the Panel suggests that CIAT should seek funding of this component of the Unit's work through the new systemwide IPM network.

Although the VRU has recently initiated some epidemiological studies on viruses of cassava (CFSV and CVMV) and beans (BGMV), there is much to be done in this area. The Panel puts forward the following recommendation:

- 8. The Panel recommends that the VRU, in collaboration with relevant entomologists, devote greater attention to the epidemiology of major virus diseases of CIAT's mandate crops, as a prerequisite to integrated control of both viruses and their vectors.**

4.2. Scientific Resource Groups (SRG)

4.2.1. Role and Objectives

As described elsewhere in this report, the last five years have seen major reductions in CIAT's commodity programmes due to funding constraints combined with an expansion of CIAT's research in natural resources management. This appeared to bring about problems of critical mass in several project areas where continual innovation is necessary. The Scientific Resource Groups (SRGs) were intended to provide a partial solution. An SRG was designed to be a cluster of scientific competences, whose function was to ensure continuity, creativity and quality in CIAT's science.

These clusters are grouped around research units/expertise groups. They are to strengthen CIAT's internal cohesion and further the Centre's ability to develop joint initiatives for funding. They are to stimulate innovation to maintain high-calibre science and to assist in strategic planning. The SRGs also are expected to assist in stimulating external collaboration. The system allows the creation of new SRGs depending on circumstances and need.

4.2.2. Current Status

The SRG approach was implemented in 1994 but is still finding its feet. Five SRGs have been formed; Genetic Diversity, Germplasm Development, Disease and Pest Management, Productions Systems and Soil Management, and Land Management. The CIAT research units (Genetic Resources, Biotechnology and Virology) and two expertise groups on Soil Research and Geographic Information Systems are associated with one or other of the SRGs. The composition of each SRG is based on the input of different disciplines from the programmes and the units/expertise groups. Each SRG has an appointed leader. The process of formulating inter-programme projects and systemwide initiatives has begun, with a view to obtaining external funds. In the pipeline are 24 projects, which have been sent to potential donors. These projects will be implemented within programmes or units, under a project leader. The Production Systems and Soils Management SRG has suggested the direction to be taken for a proposed Soil Research Unit (the Panel's recommendation in Chapter 3.5 is relevant). Within some SRGs with a high number of participants, subgroups have been formed around subclusters of scientific competence.

4.2.3. Overview and Assessment

SRGs were intended to promote CIAT's internal cohesion and its extension of research into new areas. However, their introduction came in a top-down manner during the funding crisis, when there was great uncertainty about the implications of cutbacks on programmes, units and individuals. Because of a lack of clarity regarding their functions within the institute, the result was confusion and a failure to promote internal cohesion.

They were widely perceived as primarily a new way of fund raising, while some staff felt there was a danger that they would replace programmes sooner or later.

The Panel supports the idea of creating discussion platforms to increase internal cohesion and inter-programme activities, and to overcome problems of critical mass in important research fields. However, this must not affect the mission and the programme of the Institute. Nor must the pressure for fund raising affect long-standing relationships with partners in the developed and developing worlds. The Panel has the impression that the functioning of the SRGs is gradually developing in a good direction, i.e. working groups formulating ideas in important research areas, thus strengthening the programmes. The role of the SRGs is addressed further in Chapter 7.2.

4.3. Research Services

4.3.1. Biometry Unit

4.3.1.1. Role and Evolution

The Biometry Unit is a research support unit serving all programmes and research units through advice, joint research and training in applied statistics and mathematics. This unit was created in 1993 from part of the former Data Services Unit. Since 1993 Database development is under the responsibility of IMNS reporting to the DDG for Finances and administration. There is applied research on methodologies. The Unit's staff have a background in Mathematical Statistics or Mathematics at Advanced Diploma, M.Sc. and B.Sc. level.

4.3.1.2. Achievements

The Unit has continuously collaborated in studies on methodology and research data analyses in the areas of germplasm development, genetic diversity, integrated pest management, production systems and agroecosystems. Training in statistical methods and data analysis has been an important activity over the last five years involving researchers from CIAT (105), Latin America (60), Asia (24) and Africa (50). CIAT helped establish the 'Biometrics Network' for Central America, the Caribbean, Colombia and Venezuela in 1991. The International Biometric Society supported the first annual meetings. Subsequent meetings will be financed by external sources.

4.3.1.3. Future Strategy

The Unit foresees new developments due to advances in science, the strong positive recommendations of the Board of Trustees, and the new CIAT programme activities. Four additional B.Sc.-level biometricians, paid by the programmes, have been added to the Unit in January 1995. Visiting, short term consultants invited by the Biometry Unit, and

paid by SRGs will oversee developments in the new areas of design and analysis of intercropping and agrosilvopastoral systems, quantitative genetics, population dynamics, and geostatistics. In 1995, an international symposium will be held at CIAT focusing on statistical methods in environmental research, molecular biology and epidemiology.

4.3.1.4. Overview and Assessment

The programmes have benefitted from a Biometry Unit since CIAT's inception. There have been many developments in the scope of CIAT research over the last five years, and new inputs are needed in modern aspects of biometrics and information systems research. CIAT needs a unit with the capacity and ability to handle complex data and to integrate multidisciplinary data into prediction tools such as simulation models and expert systems. Natural Resource Management Programmes need to integrate and analyze complex and often unreplicated data for prediction and extrapolation.

The Panel puts forward the following recommendation:

9. The Panel recommends that CIAT incorporate the Biometry Unit into a broader unit, headed by a senior scientist, to handle scientific data management and decision support systems.

4.3.2. Field Station Operations

CIAT research depends upon responsible and responsive management of field operations in Colombia. There are four farms - Palmira headquarters (400 ha cultivable for beans, cassava and rice), Quilichao (230 ha for tropical forages, beans, cassava), Popayán (80 ha for beans and cassava) and Sta. Rosa (30 ha for rice). CIAT works jointly with CORPOICA on Tropical Forages and Natural Resources Management at Carimagua field station of 22,000 ha, with about 4,000 ha under experimentation. Some 3,600 head of cattle are run as a commercial operation on the non-experimental part. CIAT has reduced its activity at Carimagua over the last five years, its contribution to support personnel and operating overhead costs. These were partly compensated for by an increased contribution by CORPOICA.

The stations are well run and the history of field operations on the farms has been computerized. As a result of the financial crisis, the area used by programmes at Palmira decreased from 210 ha in 1989 to 91 ha in 1994, and the local support staff from 90 to 37. The reductions in staff were compensated for by increased mechanisation. About 200 ha of the Palmira farm produces commercial crops, partly through contractors, which help offset experiment station research costs. A Farm Operations Committee which included the Field Operations Superintendent and Programme Leaders was disbanded in 1992. The Panel suggests that CIAT reinstate such a committee to provide a broader basis for consensus on its operations. This is particularly important when commercial activities such as the

production of soybeans can drastically alter the ecology of insect pests on the farm. The Panel also suggests that Field Station Operations should report to the DDG Research.

CHAPTER 5 - THE CIAT RESEARCH PROGRAMME - AN OVERVIEW

5.1. Adjusting to a Changing Environment

5.1.1. The International Community

Since the Brundtland Report 'Our Common Future' in 1987, increased awareness of environmental damage has galvanized the international community to serious discussion and some action. Environmental issues were an important focus for UNCED in 1992 and feature strongly in Agenda 21 and related international conventions on climate change, biological diversity and desertification. CIAT has been a leader in recognizing that agricultural technologies, when well-chosen and managed, can redress threats such as global warming, loss of biodiversity and topsoil, water pollution and, importantly, population migration. CIAT's 1991 Strategic Plan, published prior to UNCED in 1992, presents a research vision for the sustainable improvement of agricultural productivity as an important contributor to solving these burgeoning problems. In planning a balance between commodity improvement and research on natural resources management, CIAT was in the vanguard of adjustment to the wave of environmental awareness sweeping the world. The Panel commends the Centre for that vision and initiative.

5.1.2. The CGIAR System

Funding for the CGIAR System began to decline in real terms in 1990. While the decline affected all the IARCs, it has hit CIAT particularly severely, catching the Centre at the start of a radical reorganization. CIAT had planned for expanding funding, attracted by its innovative vision, to help manage its transformation from commodities to a research portfolio balancing these with natural resources management.

Falling funds were accompanied by donors making new demands, in part to gain leverage in their own domestic budget processes and preserve their CGIAR contributions, but also from a sense of the need to transform the system to meet new global and financial priorities. Directions were clear:

- Increase research on agricultural sustainability and environmental issues
- Improve efficiency:
 - remove duplication across centres
 - exploit synergies on themes researched by more than one IARC
 - widen partnerships to improve institutional coherence in addressing priority problems.

The CGIAR System has moved strongly to meet these demands. But the historical autonomy of the IARCs, and lack of mechanisms for systemwide operational planning, brought transaction costs. These have been compounded by two other developments. First, the new CGIAR perspective on NARS reaches beyond government research organizations (the traditional IARC partners), to the universities, NGOs and the private sector, all of which can increasingly play a role in developing country research. Second, ecoregional initiatives make demands on a range of in-country institutions from policy making to a variety of line ministries (e.g., environment, forestry and irrigation), to embrace the dimensions of sustainability beyond agricultural productivity. So in addition to the funding crisis, the pace, scale, diversity and complexity of the ecoregional and systemwide initiatives being pursued has further diverted managers from the internal needs of their centres. This has had particularly severe implications for CIAT.

The funding decline from 1991 precipitated massive efforts by CIAT's management and staff to find new sources to finance the rebalancing of programmes and the expansion of partnerships. In addition, CIAT has been assuming leadership of, or participating in, a growing number of systemwide initiatives. The effort these require has further diverted management's attention from the needs of internal reorganization and a change of culture. The number of initiatives, the need to interact with other centres Systemwide, and the transaction costs of negotiating agreements and plans with partner institutions varying tremendously in their ability to act and react, has proved almost overwhelming. There is a need to limit this burden for the moment and concentrate on CIAT's internal reorganization and the linkages required to operate its programmes effectively.

5.2. Balance across CIAT

5.2.1. Programme Balance

As outlined in Chapter 1, with the publication of the 1991 Strategic Plan CIAT undertook a major reorientation of its programmes. The vision was to build up four natural resources management programmes to balance the existing commodity programmes. Despite declining funding, CIAT management retained that vision and speeded the downsizing of the commodity programmes releasing funds to expand natural resources management research. The constant changes over the five-year period, and the ongoing evolution of the new CIAT, preclude a proper assessment of Programme balance at this time. The staffing pattern from 1989 to 1994 is shown in Table 5.1.

Table 5.1: Staffing Pattern 1989 - 1994
Senior Staff

1. Operations	Senior Staff					
	89	90	91	92	93	94
Research Programmes						
Beans	29	27	27	23	19	17
Cassava	14	13	12	12	14	13
Rice	8	8	9	7	6	4.7
Tropical Forages	18	17	18 ¹	9.5	10.5	9.3
Forest Margins	-	-	-	1	3	-
Hillsides	-	-	-	2	3	5.6
Savannas/Tropical Lowlands	-	-	-	6.5	6.5	7.4
Research Units						
Biotechnology	2	2	2	3	3	3
Virology	2	2	2	2	2	2
Genetic resources	1	1	1	1	1	-
Land Use	-	-	-	2	4	5
Impact assessment	-	-	-	-	1	1
Research Management						
Research management	2	2	2	2	2	2
TOTAL RESEARCH	76	72	73	71	75	70

¹ The Tropical Pastures Group was split into Tropical Forages and Savannas.

The Bean and Rice Programmes have borne the brunt of the senior staff cuts. Most of the staff reductions in the Tropical Forages Programme have been transfers to the Tropical Lowlands Programme. Despite these heavy cuts, CIAT has fallen short of its 1991 Strategic Plan targets for the expansion of natural resources management research. The Panel's

discussion on a future strategy for the evolution of natural resources management research is in Chapter 3.

CIAT management established an Impact Assessment Unit in 1992 with terms of reference which included *ex ante* impact studies. The Unit is working towards the use of these studies in priority setting and acknowledges that refinement of the model being used will be an ongoing process. Calculations from the model do allow a comparison of expected benefits from each programme as a basis for comparison of research investments across programmes. The data suggest, as was the case in a similar exercise the 1989 EPR did, that the Bean Programme offers more modest returns to investment compared to the others. But while such comparisons carry conviction, they provide only part of the information needed for decision-making. The criteria embraced by such economic models remains limited. For example, such models do not weigh the relative strengths of NARS, nor the availability of alternative suppliers, both important factors in deciding CIAT's priorities. Similarly, externalities as a sustainability issue are not fully captured, nor is the important purpose of ecoregional programmes in evolving an effective approach for NARS to attack the sustainable improvement of productivity.

A working group on priority setting has recently reported to CIAT management. The report identifies criteria important to priority setting for CIAT and its stakeholders, including those exemplified above. It will facilitate evaluation across the Programmes in the future. It also suggests a process which the Centre might follow in the future setting of priorities, including a quarterly routine for the comparison of project proposals to ensure that only those of greatest importance to the Centre's clients go forward to donors. The Panel commends CIAT for its efforts to improve priority setting and for a process which is transparent and involves scientists.

5.2.2. Regional Balance

While the preponderance of CIAT's resources are applied within the LAC Region, its global mandates for cassava, tropical forages and beans take CIAT's activities outside the region. Table 5.2 shows the level of programme investments for each region, and includes the allocation of research expenditure at CIAT headquarters on projects to benefit the region.

Table 5.2: Commodity Programme Regional Expenditures in 1994

Region	Cassava	Beans	Tropical Forages	Rice & N.R.M.	Total
LAC	2,533 (53.6)	3,087 (54.2)	2,230 (74.7)	6,923 (100.0)	14,773 (72.53)
Africa	1,355 (28.7)	2,584 (45.3)	182 (6.0)	-	4,121 (20.23)
Asia	834 (17.7)	28 (0.5)	613 (20.3)	-	1,475 (7.24)
Total	4,722	5,699	3,025	6,923	20,369
CIAT Expenditure %	(23.2)	(28.0)	(14.8)	(34.0)	(100.00)

- a. Expenditures are expressed in thousands of US\$ Dollars. Numbers in parentheses indicate percentage of Programme expenditure.
- b. Natural Resources Management.

Both Beans and Cassava Programmes show heavy expenditure for Africa, with the Bean Programme having 7 staff outposted there in 1994 and cassava one. Much of the cassava research done at headquarters has an African focus and is implemented in Africa by IITA with its African regional mandate for cassava. Data on expected benefits is only available for some regions in which CIAT is invested and so is inadequate for analysis of programme balance at the regional level. From available data, Beans and Cassava both show expected benefits in Africa at about 50% of the level for LAC. This suggests an overinvestment in beans in Africa though benefits for the poor, weak NARS and the fact that beans are the major source of protein for east and central Africa provide significant weighting in favour of the investment. Equivalent programme data are not available for 1990. The 1991 core fund allocations for CIAT as a whole show 17% to Africa and 8% to Asia, this total of 25% is close to the 27% percentage allocation of expenditure outside LAC in 1994.

Outposted staff were reduced from 25 senior scientists in 1989 to 18 in early 1995. Bean Programme outposted staff went down from 16 to 8 in total, and from 12 to 7 in Africa. Two additional staff were outposted in the Hillside Programme. The number of junior scientists associated with these senior staff remained similar, at 83 in 1989 and 85 in 1994.

CIAT's country operations have consistently included participatory adaptive research in farmers' fields in collaboration with NARS and NGOs. This tradition has

brought CIAT scientists the understanding that an effective farmer-back-to-farmer sequence ensures relevance, even in laboratory research. In part, this tradition gave the Centre the confidence to embark on ecoregional programmes. While it is clear that such local specific research in farmers' fields is to the potential comparative advantage of NARS, NGOs and the private sector, few of these institutions have that capability as yet and the Centres must continue to build it up, both by example and through training.

5.2.3. Women in Agriculture

CIAT has been a pioneer in articulating women's roles in agriculture, another area in which the international community has made increasing demands over the last decade. In late 1991, a working group made recommendations to CIAT management on gender analysis for research and training at CIAT. These included the need to:

- sensitize staff to gender issues in agriculture
- strengthen in-house capacity to carry out client-oriented research, including gender analysis
- create external capacity through training
- strengthen the evidence on the importance of understanding the role of gender in agriculture.

The Centre deserves credit for: highlighting the role women play; the development of participatory approaches to research planning which allow full weight to whoever takes important agricultural decisions; and its work in demonstrating how organizing local farmers, including women's groups, gives poorer people a voice in research and development planning, and gives them ownership of programme implementation.

CIAT's participatory approach is being applied throughout Colombia, Ecuador and Peru, and training with materials from CIAT is revolutionising the way rural research and development is managed. CIAT's Bean Programme has used similar techniques to pioneer farmer involvement, particularly that of women farmers, in the process of varietal selection, with outstanding results. As elaborated elsewhere, government surveys show improved materials from CIAT present on almost half the farms in Rwanda, where beans are a women's crop. Similarly CIAT's Cassava Programme has outstanding successes in processing cassava through local associations in Brazil, Colombia and Ecuador, many of them based on women producers.

5.3. CIAT's Overall Impact

CIAT does not attempt to measure the impact of all technologies to which it contributes in development at the farm level. The cost of such a comprehensive assessment would be prohibitive. Further, the nature of the technology development, adoption and diffusion process is such that the full impact of a research finding is often best seen some 20

years later, so it is impossible in 1995 to measure the impacts from research done by CIAT's programmes since the 1989 EPMR.

Over the last five years the Centre has accelerated its measurement of both expected future impact, and the impact of CIAT's earlier research. It has assessed the impact of CIAT's research on consumer prices for food, on farmers' incomes, on the way other institutions (particularly national ones) do their work, and finally on science. The culture of the IARCs in general, and CIAT is no exception, is that scientists strive to see their results in farmers fields', scientific impact being regarded as a by-product.

Examples of impact in these categories can be found in the centre's publications. CIAT estimates that, by 1990, consumers in LAC had benefitted from a 24% decrease in the real price of rice and a 5% decrease in that of beans as a result of CIAT research. Also in 1990, the internal rate of return (IRR) to CIAT's historical investments in rice research in LAC was calculated as 69%, and to bean research in LAC as 16%. A later study estimated that bean varieties either from CIAT, or based on CIAT material, are grown on 705,000 ha, and the extra benefits brought a 24.5% return to the investments in the Bean Programme over the period 1973-92. National-scale case studies of the adoption of improved climbing beans in Rwanda and cassava in Thailand have been completed since the last review as well as more localised adoption studies in a number of countries.

A novel 1994 contribution is an *ex ante* assessment of returns on research to prevent soil loss in LAC hillsides. This showed an IRR of 53% on the adoption of erosion control barriers, and an IRR of 34% for improved fallow. The model showed rapid and high returns from erosion barriers used to reduce downstream sedimentation where this is already an existing problem. The analysis highlights the importance of these externalities which puts a premium on the selection of sites where both on- and off-farm impacts of natural resources management interventions can be measured. A benchmark for this analysis is the fact that in the year 1994, 20% of the farmers in the Hillsides pilot microwatershed in Cauca, Colombia, established erosion barriers.

Less obvious are the impacts on institutions through training and collaborative research. Yet the sheer scope of CIAT's networking and consortia activities, and the enthusiasm of the NARS for CIAT's continuing participation, even after formal devolution of networks, speaks well for the Centre. Scientific impact is a secondary consideration in CIAT but is an indicator for which observers of a research institution have expectations. Perhaps the most currently topical impact on science is the better understanding of the potential for carbon sequestration by improved pasture forages, an achievement recorded in an article in 'Nature' in 1994. The data in table 5.3 is a more conventional measure. Drawn from the Information and Documentation Unit's database it shows the total number of publications each year since 1990, separating articles in refereed journals, non-refereed sources and CIAT's own publications.

Table 5.3: Publications by CIAT Scientists

Year	1990	1991	1992	1993	1994
Senior Scientists * (no.)	72	72	71	75	70
Refereed journal articles (no.)	65	50	47	45	40
Refereed article per scientist (no.)	0.80	0.67	0.60	0.58	0.56
Non-refereed articles (no.)	115	78	67	136	84
CIAT Publications (no.)	205	202	245	124	90

* Includes Research and Research Support Senior Staff

The table shows a consistent fall off in the number of refereed publications per senior scientist over the five year period. A CIAT average of 0.56 refereed papers per senior scientist for 1994 is low (there may be some unknown 1994 papers still to enter the database). In 1993 and 1994 there has been a marked fall-off in the number of CIAT publications with perhaps some compensation in the non-refereed category. Overall it has perhaps been a result of having to cope with the internal crisis and the mobilization of scientists in preparing funding proposals. Programmes have performed differently: the Bean Programme shows a marked increase, doubling its refereed output from a lower than average 0.67 per scientist in 1990 to 1.24 in 1994. The numbers for Cassava and Tropical Pastures (aggregating Lowlands with Forages for 1994) dropped, with Cassava showing a low 0.31.

5.4. Assessment

The Panel have been impressed by the logic of the 1991 Strategic Plan, and, on the natural resources management front, by the care taken in the selection of the three priority ecosystems; the savannahs, the hillsides and the forest margins. The Panel encourages CIAT to continue to move towards the balance between commodity and natural resources management research set out in the Strategic Plan as an objective for the year 2001. However, the Panel is convinced that expansion of the natural resources management programmes at the expense of the commodity programmes has reached its limits. New reductions in staff would threaten cohesion and further depress morale within the commodity programmes, as well as requiring the sacrifice of important research areas. Over the next year or two the pace of expansion of natural resources management research will be dependent on whether new funds can be attracted.

The Panel believes that the performance of the existing natural resources management programmes, and the impression made on national and regional partners, will play a major part in attracting new funds. For this reason the Panel has suggested, in

Chapter 3, that the human and funding resources presently employed in the natural resources management research be more closely focussed, notably by bringing the appropriate balance of necessary disciplines to bear at fewer sites. The Panel is confident this will improve the chances of early success and of an early, positive, impact on partners and donors.

As noted in section 5.1.2 the Panel is impressed with CIAT's efforts to develop a transparent and participatory priority setting process. It is acknowledged by management that the process needs refinement but its essentials seem to have support among scientists. When the Board have approved a process, the Panel suggests that its early application across all CIAT projects will provide a suitable opportunity to revisit questions of balance, between commodity and natural resources management programmes, and within the commodity programmes. The Panel believes that institutionalising a routine project evaluation process will bring greater coherence to project design and proposal submission to donors and will minimise the writing burdens on individual scientists. In similar vein there is a need, certainly over the next year or two, to limit new commitments to leadership in systemwide initiatives and to focus CIAT management on restoring communication and confidence with staff and with the external partners on whom its programmes depend for their effectiveness.

The Panel is impressed by the growing evidence of the impact of all CIAT's commodity programmes. The natural resources management programmes are relatively new, however the Panel are confident that the better understanding of the potential of carbon sequestration by improved tropical forages, and the rapid adoption of erosion barriers by hillside farmers, provide a foretaste of things to come. Over the last five years CIAT has made a great effort to develop information on the impact of its programmes. However, as is noted in section 5.3, the high cost and the complexity of measuring the impacts of all CIAT products, make a comprehensive exercise prohibitive. The Panel suggests that CIAT develop a cost-effective impact assessment strategy, from a Centrewide perspective, which will aid programme planning and satisfy its stakeholders as to CIAT's performance.

CHAPTER 6 - INTERNATIONAL COOPERATION

6.1. Institutional Relations

6.1.1. Host Government

CIAT enjoys outstandingly good relations with its host, the Government of Colombia. Discussions with CIAT management revealed no major issues pending between the two sides. The Panel Chairman (Main Phase) had an opportunity in Bogotá to discuss the relationship with the Vice-Minister for Agriculture (the Ministry being the Centre's formal host in Colombia), with the Acting General Manager of ICA (which for many years was the country's principal research body but now has mainly regulatory functions), and with the Executive Director of CORPOICA (which has taken over the research responsibilities from ICA). These discussions confirmed that CIAT and Colombia have a warm relationship, and close practical cooperation. There do not appear to be major points of tension.

A remarkable proof of this is the fact that in 1994, the Government became a generous donor to CIAT and thus a member of the CGIAR despite budgetary difficulties of its own. Its 1994 special contribution was 1,000 million pesos (equivalent to about US\$ 1.2 million). For 1995, an increase to 1,300 million pesos is planned (probably about US\$ 1.5 million, depending on exchange rates at the time). The pledge to CIAT takes the form of restricted core funding for ongoing projects. Joint mechanisms have been set up to handle project selection.

For future years, the Colombian authorities expect to be actively involved in the formulation of the projects which their contribution will finance. This is in line with the new host country agreement referred to in Chapter 8.1. Maintenance of the current excellent relationship will require CIAT's sensitivity to the fact that CORPOICA is a very different, and potentially much stronger, partner than was ICA. For its part, CORPOICA will need to be sensitive to CIAT's regional and global mandates, and aware of the complex decision-making processes of a CGIAR centre. A fruitful domain for joint planning and research could be problems of common interest to Colombia and other countries in the region.

6.1.2. National Agricultural Research Systems

Four levels of contacts can be identified between CIAT and NARS: The Director General formally interacts with NARS Directors, reviewing historical relationships and laying the basis for future collaboration. The Deputy Director General for Research, the CIAT Office for Institutional Relations and Development Support and the Programme Leaders interact with national research managers and scientists to evaluate and plan collaborative

activities. CIAT outposted staff, often based on a local research station, work collaboratively with NARS scientists. Finally, interaction occurs through networks, conferences and training courses as well as the flow of genetic material and collaborative observation on its local performance.

In the course of country visits, Panel members listened to some of the Centre's NARS partners, and in a few cases with partners in universities and in the NGO and private sectors. In general, in Africa, Latin and Central America, and Asia, the Panel found partners with a favourable impression, both of the value of CIAT to them and of their relationship with CIAT. Panel members heard particularly strong expressions of support for the Bean networks in Africa.

Within this broad collegiality there were criticisms. The funding crisis at CIAT has required rapid action from time to time, especially in the programmes most heavily cut. This has sometimes been taken without adequate consultation. The Panel's attention was drawn to the loss of technical support from CIAT after devolution of the coordination of the PROFIJEROL network to the central American NARS in 1993 and the withdrawal of a Bean Programme staff member from Brazil. Similarly, the decision to close down research on irrigated rice and suspend support for the INGER, CRIN and RIEPT networks evoked a critical reaction from several LAC countries.

Subsequently, as described in section 2.4, CIAT has handled the continuation of irrigated rice research by the creation of a private sector based consortium, and has made a commitment to support it. Through this innovative initiative the Centre has regained its credibility among the major rice producing countries of the region.

6.1.3. Global and Regional Organizations outside the CGIAR

Developments at global and regional levels are bringing CIAT into contact with an ever-widening range of organizations, and are leading to intensified cooperation with long-standing partners, especially in the field of NRM. The trend is towards shared endeavours among many partners in tackling the complex problems of sustainability. Typically, a major exercise such as the global initiative on Alternatives to Slash-and-Burn involves IARCs, non-CG centres, bilateral aid programmes, United Nations agencies, NARS and NGOs. Cooperation with different types of organization is no longer conducted in a series of watertight compartments.

CIAT has been extending its cooperation, both directly and in broad-based initiatives, with IICA, CATIE and other regional organizations. Globally it is developing new links with non-CG centres such as IBSRAM (in the SWNM initiative) and with United Nations programmes (notably UNEP on GIS and indicators of sustainability).

While the Panel has incomplete information on how CIAT is viewed by its partners, it believes that the Centre has a reasonably good record of cooperation. Some

difficult relationships were encountered in the ASB (Latin America) exercise (a reference is made in Chapter 3.3). No other specific problems came to the Panel's attention.

The trend towards greater cooperation among organizations is clearly a good thing, and in earlier chapters the Panel has made some suggestions on the development of further links. Nevertheless, there are limitations on how far such a trend can go. Every joint endeavour has transaction costs, and the time spent by scientists on liaison and consultation reduces the time they can devote to their own research. At some stage, the Centre will have to consider trade-offs, and may find it advisable to put a brake on involvement in additional multipartner exercises.

6.1.4. Advanced Research Institutions

In earlier chapters covering the work of individual programmes and units, cooperation with advanced research institutions has been frequently mentioned. Altogether, more than one hundred institutions interact in one way or another with CIAT. In the Panel's judgment, both the CIAT strategy and its culture strongly encourage the development of such relationships. In areas of new technology (virology, biotechnology, GIS) the Centre appears to have struck a reasonable balance between building up in-house capacity and relying on advanced institutions.

6.1.5. CGIAR Centres

Recent CGIAR policy has encouraged the development of ecoregional and systemwide initiatives. This has dramatically increased the level of interaction between centres. The formation of consortia, with other IARCs and with NARS, to plan and implement these initiatives has been a major preoccupation for CIAT over the last three years.

The Centre is currently involved in fifteen consortia or alliances, of which ten have been proposed or formed since the beginning of 1994. CIAT is playing a convening or leading role in eight of these fifteen institutional groupings (Annex VI refers). With CIAT also managing a funding crisis this very rapid pace of change penalised the consultation process, both on downsizing and on the formation and allocation of responsibilities in consortia. For example some difficulties have emerged in the implementation of the ASB programme in Rondonia and Acre. CIAT perhaps needs to be more assertive, in its capacity of ecoregional convenor for LAC, in arbitrating complaints within that consortium.

CIAT seems to the Panel to be torn between giving priority to its internal health and positioning itself strongly in this new dimension of the CGIAR. Evaluation is difficult until the dust dies down and currently the appropriate balance is difficult for management to assess. However, it is clear that the internal integrity of the Centre is the *sine qua non* for success at the System as well as the Centre level. The Panel is convinced that once the dust settles there will be plenty of systemwide opportunities remaining and believes a strong role

can be played by CIAT's discipline-based Units over a range of themes. For the moment the Centre should come first.

In visiting IITA, Panel members were pleased with the collegial relationship with CIAT staff they observed. The Panel believe, however, that greater synergy could be realised from this long standing collaboration, in particular by a closer focus on the needs of Africa in priority setting by the CIAT Cassava Programme. IITA is clearly in a strong position to help articulate these priorities.

The country visit to Uganda provided the inter-centre highlight of the Panel's travels. The NARS of Uganda is in negotiation with several IARCs, including CIAT, to bring their regional staff to join national staff in reviving Namulonge research station, a well-known name in the history of research in east Africa. The Panel was encouraged by the potential of this development.

6.1.6. Networking

All CIAT programmes have been active in the development of networks. A network usually starts with external funding, and with CIAT coordinating the activities. It is expected from the outset that, over time and in an orderly manner, the NARS will take over the coordination and management functions, with CIAT continuing to provide technical and logistical support. CIAT also works through networks other organizations established, notably those sponsored by IICA.

CIAT has developed a participatory planning-by-objectives approach involving the network steering committee, NARS scientists and extension staff, and in some cases NGOs. A sense of the collective 'ownership' of the network has been deliberately fostered. Collaborative research is encouraged, to make best use of scientist capabilities and of the different environments in which they operate. Project funding is normally available through the network in amounts ranging from US\$ 1,000 to US\$ 4,000 per project per year, and is the glue that holds the network together. The networks provide training and information, serve as a channel for the distribution and testing of germplasm (most of it at present coming from CIAT), and arrange collaborative and multilocal experiments.

The networks have been specially useful in organizing farmer participation in both on- and off-farm trials, particularly for germplasm selection and seed multiplication. They have also been a vehicle for CIAT research on the role of farm communities and local markets in the adoption of new cultivars.

The pace of devolution from a CIAT-driven to a NARS-driven network has in some cases been unduly hastened by recent funding problems. The sudden withdrawal of CIAT scientists supporting a network can threaten its survival. The Panel draws the attention of donors to the need for a phased reduction if support has to be cut back, and the

attention of CIAT to the importance of giving weight to network support in the allocation of core funds, however tight.

The chapters dealing with the respective research programmes have mentioned the principal networks. In Annex VI, CIAT-sponsored networks, and those in which CIAT is currently a participant, are listed by programme.

6.1.7. Donor Relations

In a climate of financial stringency, the concept of 'donor relations' becomes a euphemism for fund-raising. Here CIAT's record in the last few years is overshadowed by one central fact: supplementary funding spectacularly failed to meet the gap that opened up in the early 90s as resources were shifted from commodity programmes to natural resources management research, and total core funding fell away at the same time. In hindsight, the centre (like other IARCs), made a serious overestimate of what donors were ready to do for NRM, and an equally serious underestimate of the financial constraints building up in the traditional supporters of CIAT and the CGIAR as a whole.

Even if CGIAR core-funding remains stable in the next few years, CIAT will undoubtedly be making extended efforts to garner supplementary resources. The Panel supports the view of the Board that non-core funding should only be sought, or accepted, for activities in line with the Centre's strategy. This is essential for credibility, and to avoid the charge of opportunism.

The Panel also believes that CIAT will need to manage its donor contacts more systematically as it increases its fund-raising efforts. There is currently no shortage of project ideas, but donors are not going to be grateful to CIAT if they receive uncoordinated approaches from different staff members at the same time. CIAT's recently developed procedures for setting priorities among project proposals can assist the overall management of resource mobilization. The Project Development Office (PDO) is a good source of information on donor priorities and procedures, and could be given a bigger role to play in coordinating initial contacts and organizing follow-up.

6.1.8. Institutional Support within CIAT

Its institutional relations role brings the IRDS office important tasks in facilitating country operations, liaising on Programme activity and providing institutional strengthening in support of this through its training, information and documentation thrusts. The office has been severely affected by the budget reductions, and its staff have shown great devotion in coping with a large workload despite many problems.

The office also has a role in supporting the convening and organization of systemwide and ecoregional initiatives which involve a range of institutions. Coordinators of these activities, as well as Programme and Project Leaders, can benefit from its support and

counsel. The Panel believe it is important that they discuss their intentions with IRDS and keep it well informed of their in country activities. Within the new organizational scheme advanced in the next chapter, the Panel hopes that the office can play a high-profile policy role in the management of the Centre's external relations with NARS (including the new actors at national level), with donors and with the CGIAR.

6.2. Training and Information

6.2.1. Training at CIAT

6.2.1.1. Evolution and Achievements

CIAT entered the 1990s with a three-part training strategy:

- To shift from group training in general agriculture and focus on specialized training of groups and individuals in disciplinary science.
- To give early leadership to the expansion of training capacity in research at national and regional levels.
- As this training capacity expands, to reduce involvement by CIAT, but continue to develop training materials.

The Centre has adhered to this strategy through 1994. However, the changes in organization in 1991, and the funding reductions since then, have altered the face of the training establishment in CIAT.

The Training and Communications Support Programme was subsumed into Institutional Relations and Development Support in 1992 (first named a programme, but now titled as support), under an Associate Director. Training support lost two-thirds of its resources between 1991 and 1993. Of the nine professionals in the Training Associates cadre, who were very successfully supporting CIAT training in 1990, only one remains in 1994. The positions of staff in the training-of-trainers projects and in the training materials section were transferred to a self-financing scheme based on contracting out their services while staying within CIAT's mandate boundaries. By contrast resources devoted to training by CIAT's research programmes and units have been maintained at a level commensurate with the number of trainees coming to CIAT.

Table 6.1 gives details of professionals from NARS and from developed countries trained at CIAT for the years 1990, 1992 and 1994 by type of training. (IC = Introductory, SC = Specialized, MS = Masters, Ph.D = Doctoral). Falling funds accelerated CIAT's planned withdrawal from introductory level group training by 1992 while the shortage of funds has inhibited the expansion in specialized training.

Table 6.1: Types of Training at CIAT by Programmes and Units 1990,1992 and 1994

PROGRAMME/UNIT	YEAR	GROUPS		INDIVIDUAL			TOTAL
		IC	SC	SC	MS	Ph.D	
Programmes	1990	9	99	62	6	6	182
	1992	6	-	28	9	8	51
	1994	-	19	35	8	9	71
Units	1990	-	-	19	-	1	20
	1992	-	21	15	9	1	46
	1994	-	56	32	11	8	107
TOTAL	1990	9	99	81	6	7	202
	1992	6	21	43	18	9	97
	1994	-	75	67	19	17	178

The yearly average of NARS trainees at CIAT fell from 213 for the period 1987-91, to 97 in 1992 and 71 in 1993. 1994 shows a significant recovery to 178. Part of the reduction was due to winding down introductory courses, part the switch to heavier dependence on outside funding sources for CIAT trainees. The trends in the table suggest a growing demand for specialized group training in the Research Units - perhaps a sign of the times. Training towards higher degrees, always funded from outside sources, has increased over the period, and Ph.D training has doubled. But over 50% are from developed countries, almost always funded by their home country.

In-country, and to some extent, introductory, research and production courses at CIAT, have been devolved by developing national and subregional training capacities. The strategy has been to identify potential training institutions, train their trainers, supply them with state of the art training materials, and assist them in preparing and submitting projects for 3-5 years funding.

The main project, funded by IDB, started in July 1991 and identified two subregional teams; in Central America, Mexico and the Caribbean for bean training with 21 trainers; and, in the Southern Cone, for cassava with 20 trainers. It also identified institutions for rice training in the Dominican Republic (21 trainers), Colombia (20 trainers),

Ecuador (10 trainers) and Venezuela (16 trainers). The teams achieved recognition in their constituencies and each prepared a post-training action plan for funding.

At this time, the Central American bean team and the Venezuelan rice team have started training. The Ecuador team have been adopted by FENNARROZ, the national federation of ricegrowers, the Colombian team is awaiting the reorganization of ICA, and funding is being sought for the Southern Cone team, supported by CIAT.

Additionally, teams were trained in the planning, monitoring and evaluation of agricultural research management with the help of ISNAR (18 trainers from 11 countries), and also in the management of technology transfer in Colombia (24 trainers). This last initiative, based on participatory research methods, will cascade through the 1,000 municipal units for technical advice to farmers in Colombia, and is now being repeated in several other countries.

The devolution programme has left CIAT with a skilled trainers training unit, including the development of written and video materials. CIAT believes this capacity could be used by regional institutions and other international centres.

6.2.1.2. Future Strategy

Two objectives will remain the focus of future training strategy in CIAT:

- The training of NARS scientists working in high priority research projects on both an individual and group basis
- Building subregional capacity for training technology intermediaries in commodity production and in participatory relations with farmers.

This second objective continues to emphasise devolution through the training of trainers, the provision of training materials, and assistance in the search for funding to mobilise the skills created. In the training of scientists, a new thrust will be in natural resource management research. This will be organized interinstitutionally and steps towards a consortium of IICA, CIAT and CATIE, with IDB funding, are well advanced.

6.2.1.3. Assessment

In the context of a Board and Management decision to try to maintain CIAT's human research capability in place, the erosion of training support and funds has inevitably had an impact on the volume of training supplied by CIAT. Against this background the strategy to develop subregional and national training capacity has been effectively implemented. An external evaluation on behalf of IDB, the donor, while acknowledging the duration of the project was too short, said:

"CIAT and the Bank should be proud to have jointly fostered a stellar example of a learning strategy undergirding the technology adaptation and diffusion process."

The Panel believes that CIAT has, after a series of adjustments, successfully accommodated its training strategy to its evolving circumstances. It would like to emphasize that the subject matter focus of training should be demand-driven, albeit of course within the CIAT range of specializations. The consortia being pursued with regional partners should be organized to articulate regional needs. Within the consortia arrangements the training needs of small countries, particularly those with large numbers of poor farmers, should be protected. The interface of researchers with small farmer communities is essential to technology design for their circumstances, but remains weak in most countries. Training of trainers in community dynamics and participatory methods remains important.

The Panel commends the increase in graduate students at the Ph.D level over the last five years. It believes this offers valuable leverage to increase CIAT's research output as well as providing important experience to the next generation of researchers. The Panel encourages CIAT to continue increasing numbers of developing country Ph.D students and urges the Centre to seek finance where this is a bottleneck.

6.2.2. Information and Publication Services

6.2.2.1. Evolution and Achievements - Information and Documentation Unit

In the period 1989 to 1994, the Information and Documentation Unit has made a major investment in emerging technologies. An automation plan, developed late 1989, has evolved a fully electronic library with desktop access for CIAT staff to internal and external databases. It has electronic networking across institutions, including other IARCs and partners in special projects, and supports E-mail and the transfer of data files. Other measures have increased public awareness and use of publications, databases and other resources in the CIAT library.

The increased automation is reflected in the large increase in database searches from 272 in 1987 to 3,002 in 1992 and in the fact that cataloguing and indexing productivity improved by 35%. The last EPMR (1989) indicated that only 4% of search requests came from Africa and Asia compared to 40% from within Colombia. By 1992, the Africa and Asia figure had risen to 9%, an improving balance with the reducing proportion of searches being made from within Colombia (19%).

The improvement in productivity is impressive when seen against the decline in human and financial resources. The Unit absorbed a 50% reduction in personnel (15 full-time) over 1992 and 1993. The operating budget of the unit has declined by 4% per year in real terms since 1989, against an annual inflationary increase averaging 18% in the cost of journals.

The production of abstract journals on cassava, beans and forages, with a 20-year history in CIAT, ended in 1992. Other cost-cutting measures included a reduction by 875 titles in the number of journals purchased, with little possibility for subscribing to new journals and databases required for the resource management programmes. The Unit has come to rely more on secondary alert services such as Current Contents to identify and obtain specific articles of interest. While cost-effective for CIAT scientists, this has eroded CIAT's traditional services to clients in the region.

6.2.2.2. Future Strategy

The Unit will continue to automate. CIAT has recently obtained full interactive access to the Internet and the Unit will take the lead in publicizing and providing access to services available to CIAT staff, particularly in the information intensive areas not well served in-house. Continued efforts will be made in electronic publishing. The Unit's specialists have started to liaise with each programme and each SRG to ensure that its services and products are based on internal demand. The Unit will also provide leadership in linking with the other IARCs in the Systemwide information initiative and in bringing access to CIAT's information and databases to external clients, including CIAT outposted staff.

The Unit has proposed that information and documentation be a line item in all special project budgets to cover the costs of information resources needed.

6.2.2.3. Assessment and Recommendations - Information and Documentation Unit

The Unit has revolutionized CIAT's organization and dissemination of scientific information over the last five years, despite shrinking resources. The task continues. The connection with Internet, together with the CGIAR-wide information initiative brings new challenges.

Changes proposed in Chapter 9.3.2 on the organization of information systems at CIAT, and in Chapter 7.6 on organization and structure, are likely to involve a consequential change in the administrative placement of this Unit if all the Centre's information-oriented services are to be brought together, reporting to the proposed new Associate Director for Research Support and Information Services.

6.2.2.4. Publications Function

Since the last EPMR Review, a public awareness component has become a more substantial portion of the Publications Unit's activities. This change was a result of funding cuts and a response to the need of donors for more information about CIAT. Some staff now question whether the balance has shifted too far away from the traditional role of scientific communications.

The Panel believe that both the scientific communications function and that of public awareness are important to CIAT's future and the fulfilment of its mission, and recognizes that the proportion of effort needed to accomplish both goals may fluctuate from time to time. While this distribution of efforts should be motivated, the Panel believes that the Unit is currently making every effort to achieve appropriate goals in both areas.

CHAPTER 7 - RESEARCH MANAGEMENT

7.1. Introduction

Research Management

As in other scientific institutions, research management is the responsibility of research directors, programme and project leaders, and scientists, supported by administrative staff. Since 1989, CIAT has deliberately moved from 'programme' management to 'project-based' management of research, and has introduced major changes in the way the research agenda is set, the plans are prepared and implemented, and the administrative systems and organizations mechanisms are used for research management. At the same time, as noted elsewhere in the report, the Centre has weathered serious funding shortfalls, compounded by a leadership crisis.

These crises have inevitably taken a toll on the effectiveness with which research has been managed, and the well being of the individual scientists and other staff. Although the Centre is now emerging from this difficult phase, and is already headed in the right strategic direction, a concerted effort by senior managers would be needed in the immediate future to improve further the internal environment for research. Various aspects of the systems and processes used by CIAT to manage its research effectively and efficiently are discussed below. These include research planning, priority setting and resource allocation, research organization and project-based management, leadership and culture, and interaction between headquarters and outposted staff.

7.2. Plan Preparation

CIAT's redrafted Strategic Plan of 1991 was well received; and continues to give direction to the Centre's research programmes. It emphasizes the need for a strong commodity and resource management programmes perspective. It envisages a gradual increase in resource management research (RMR) to about 40% of the research budget; and increased integration of germplasm and NRM research, with strengthened linkages between CIAT and other institutions.

While the 1991 Strategic Plan remains in effect, the Medium-Term Plan (MTP) to operationalize the strategy has undergone several iterations during the past 4 years. CIAT's latest MTP, covering the period 1993-98, is based on TAC's Systemwide review of Priorities and Strategies undertaken in 1991-92; and radically cuts the previous MTP (for 1992-96) by about 20%. The Board, while recognizing the overall funding constraints,

decided in 1992 to keep the strategy unchanged; and asked Management to accelerate implementation to 2-3 years from the earlier 5-7.

Management's response to the Board's decision on the medium term plan was to prepare an 'Action Plan' which, after two major revisions, received Board approval in November 1993. This Action Plan was largely put together in late 1993 by two Task forces led by senior managers (and was based on rather limited consultation with programme leaders). It recognizes the severe funding crisis faced by the Centre, and proposes steps to improve internal efficiencies and reduce operating costs (including personnel). It also proposes the introduction of a matrix organization and project-based management system to ensure efficiency accountability and provide for the sharing of competencies where they may have fallen below critical mass. This Action Plan has been under implementation since February 1994; it provides the basis for the 'Funding Request for 1995' submitted in August 1994 for TAC approval.

The essential logic of this proposal was that, since the Board had decided to retain the Strategy while accelerating its implementation and the cuts in budget and staff were unavoidable, it made sense for CIAT to retain a skeletal structure of commodity and NRM programmes and to provide a flexible organization and project-based management structure enabling the Centre to "re-grow" as funding increased. This would be mainly through additional complementary resources. The Board and Management recognized the danger of CIAT in time becoming donor driven or losing direction and focus (which could then undermine donor confidence and reduce funding over the longer term). But it considered this risk manageable, provided the Centre kept a close watch over the kinds of research it undertook.

The key issue is: Did CIAT try to do too much too fast by expanding programmes in the face of a reduced budget, thus straining the organization beyond its capacity? The Panel believes that while the skeletal approach to downsizing was a reasonable and responsible approach at the time, it has been taken to its limit and any further downsizing would require the Centre to make a thorough review of its programmes.

7.3. Decision-Making and Resource Allocation

Centrewide decision-making and resource allocation is undertaken by the Director General and his top management team of two Deputy and two Associate directors. This team also meets regularly as a Directors' Committee chaired by the DG to review institution-level issues, and the concerned directors follow up as appropriate. In addition, there is a system of 13 Standing Committees and Working Groups, prominent among which are the Programme and Operations Committee, and the Scientific Resources Committee, both chaired by the DDG-R. This Committee structure is supplemented by various formal and informal means of decision making at the level of the Directors, Programme leaders and Unit/Section heads, in which individual scientists and other staff are involved. Decisions

regarding the relative priorities and resource allocations to programmes are guided by the 1991 Strategic Plan document and subsequent medium-term action plans. On an annual basis, resources are allocated according to the TAC-approved Funding Request, which includes details of the proposed projects, each with a summary budget. The Centre also continuously monitors the interests of the donor community, and adjusts its resource allocation to projects and other initiatives, as appropriate.

Currently, not all Committees are functioning effectively and on a regular basis, and that despite the elaborate mechanisms for encouraging broad-based participation, decision making in CIAT is rather centralized. The centre is still undergoing substantial changes in leadership, funding and organization, and there is still some uncertainty regarding future programme priorities, so broad-based participation is difficult but important. It is expected that once the new DG takes office later this year, and the proposed systems for setting priorities and project budgeting become firmly established in the next few years, the Centre would move toward a more decentralized mode of decision making and the basis for resource allocation would become more transparent.

In the meantime, the Panel urges that the Programme and Operations Committee and the Scientific Resources Committee be used as intended, and that these Committees meet regularly with a pre-announced agenda and minutes of previous meetings, so that their advisory, planning and integrative functions are further emphasized. This would help ensure that both scientific excellence and relevant research would receive due attention in planning and priority setting, as per CIAT's mandate. It would also help devolve appropriate decision making from the managers to the scientists, and would make the planning process more participative and transparent.

7.4. Internal Review Processes

This section describes the processes used by CIAT for project development and assessment, and internal and external reviews of programme activity.

CIAT proposes to use Projects and Project Areas (some 33 at present) as the basis for priority setting (of activities) and fund allocation in future. A draft procedure for project evaluation has been prepared also covering proposals with budgets larger than US\$ 100,000 intended to go to donors. CIAT has prepared a comprehensive guide to project identification, design, approval and administration. CIAT has excellent facilities for preparing project documents. The DG would initiate approaches to the donors by handling projects of less than US\$ 100,000 with the DDG (R) and the DG.

The Research Programmes hold Annual Review and planning workshops lasting for one week involving senior and scientific/supervisory staff within the Programme, staff from related Units and the DDG-R. Reviews do not always involve all outposted staff. In future, CIAT proposes that the process will concentrate on project reviews, priority-setting

and annual work plans. NARS collaborators are sometimes invited to these reviews. Because of the EPMR an Annual Centre Review was not held in 1994. However, individual programmes carried out annual reviews as normal. Programme reports are extensive reviews of activities usually produced annually and distributed to collaborators, donors and other interested parties.

All research publication drafts are sent to the DDG-R who appoints 3 internal referees to advise on acceptability or otherwise. The Panel suggests that the CIAT Publications Committee be strengthened. The SRG Leaders advise on the annual Outstanding Research Publication Award and the Programme and Operations Committee advise on the Outstanding Senior Scientist Award.

CIAT conducted internal reviews of its programmes and units with advice from outside consultants during the reporting period. CIAT's Rice Programme was also reviewed by the TAC-commissioned Inter-Centre Review of Rice in 1992. In 1995 CIAT will institute internally commissioned external reviews (ICER) on a continuing basis beginning with Resource Management Programmes in June 1995. These ICERs will be conducted by up to three external panellists. CIAT will conduct an internal review of Germplasm Development in November 1995.

A CG systemwide review of CGIAR Centre Genebank Operations will be held during 1995. Several workshops with external contributions and reviewers will be held during 1995 to determine priorities, prepare documents and funding proposals for CIAT-led CGIAR systemwide and Inter-Centre initiatives.

7.5. Programme Organization

7.5.1. Structure

CIAT's structural organization chart describes reporting responsibilities and relationships. Traditionally core research has been conducted within Programmes and the work of Programmes is supported by Research Units and Services. The Panel notes that currently some similar services (especially information services) are distributed throughout the organization, that the position now titled Associate Director, Resource Management Research could be more effectively used, and that service units that directly support research would be more effective if housed organizationally within the research area. The Panel therefore advances the following recommendation:

10. The Panel recommends adoption of the organizational structure depicted in Chapter 7, Figure 1, of which the main elements are:

- Establishment of a position of Associate Director for Research Support and Information Services in place of the existing post of Associate Director for Natural Resources Management;
- The research support units and the units handling information systems and services should report to the new Associate Director.

The Panel believes that this approach to programme organization emphasizes the primacy of research and is a more efficient use of existing human resources. This recommendation does not require additional staff. We believe that CIAT's natural resources management programmes can be better integrated into the overall institutional direction of CIAT by having programme leaders report directly to the Deputy Director General for Research, and that a coordinated approach to information services and programme support will enhance performance in all programmes.

7.5.2. The Soft Matrix

There has been considerable confusion within CIAT about the new 'matrix' organization. The scheme was originally intended as a structure for organizing project-based research and providing mechanisms for communications and the generation of project ideas across programme lines. It included the creation of SRGs to encourage the development and implementation of projects between previously autonomous, essentially independent programmes. The plan proposed empowering scientists and scientific teams, instead it generated uncertainty about authority and reporting relationships. Because the plan was developed with limited scientists' input or participation it was viewed with suspicion, and even alarm.

One of the key elements feeding the confusion was the role of SRGs. The organization chart, distributed at the time of their inception, appeared to give SRGs management responsibilities in conflict with those of the programmes by showing units as reporting to SRG Heads. In the ensuing confusion some SRGs were inactive, some were both active and productive, while still others began to establish plans for both developing and managing projects. Subsequently the Board clarified this issue by adopting a policy expressly prohibiting SRGs from managing projects. One SRG (Land Management) continues to manage projects, including the GIS Unit. Chapter 3.4 of this Report addresses this discrepancy.

By reducing the potential power of these new disciplinary clusters the Board created a "soft" rather than a hard matrix, making it less a management tool and more a conceptual scheme useful for communications and illustrative of the cross discipline nature of research within CIAT. The Panel believes that Board action in this regard was appropriate

and helped CIAT retain the capacity to form competency groups across programme lines without creating a climate of competition and uncertainty.

However, the use of SRGs as the "soft" dimension is still a source of confusion partly because their role and functions are still evolving, and there is overlap with the Research Units. To overcome this, the Panel puts forward the following recommendation:

- 11. The Panel recommends the use of the matrix depicted in Chapter 7, Figure 2, to describe the conceptual interaction between competency groups (which include both SRGs and Units) that provide input and the research programmes that are essentially responsible for output. All research projects should continue to be implemented within Programmes or Units.**

Figure 7.1. Proposed CIAT Organizational Chart

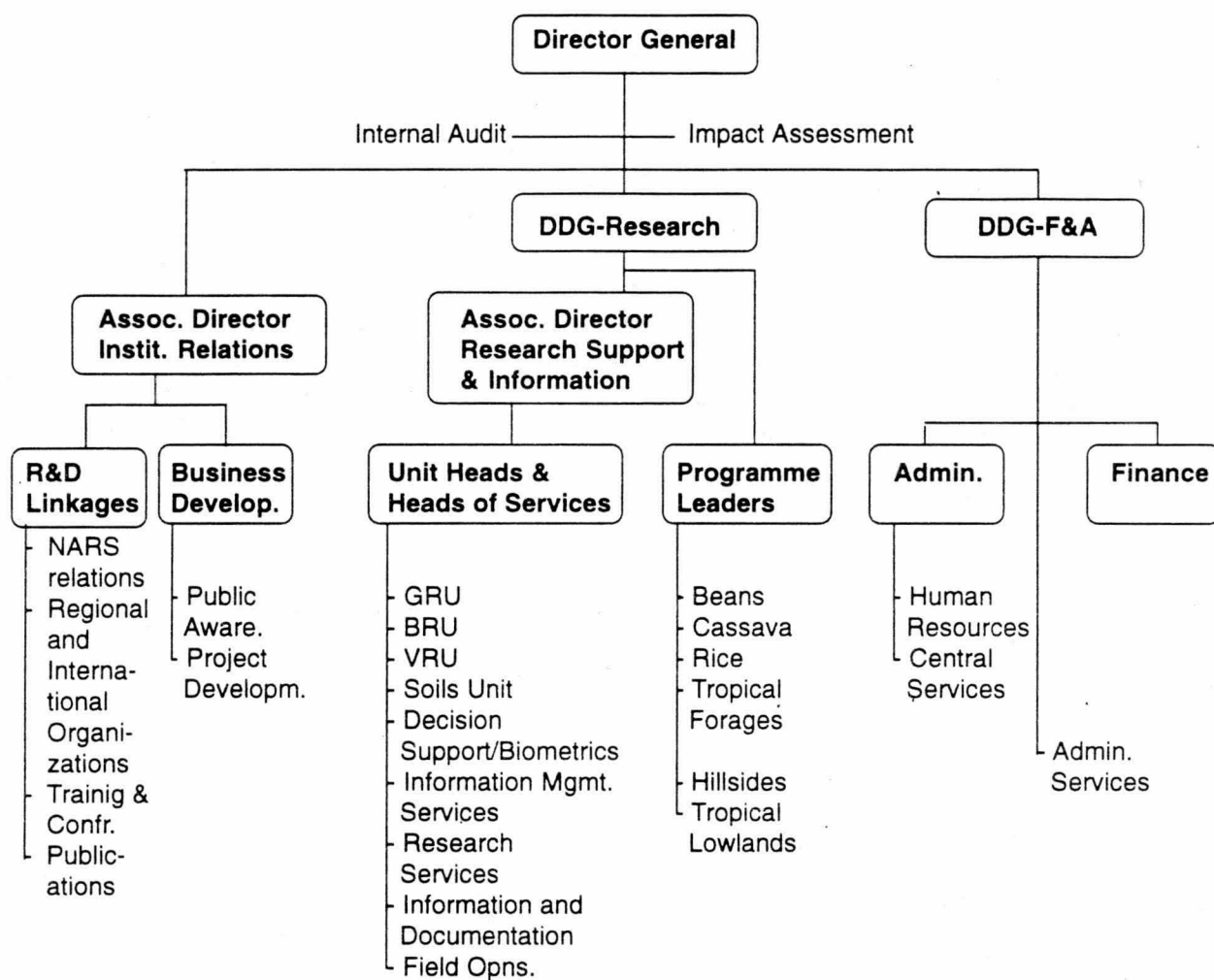
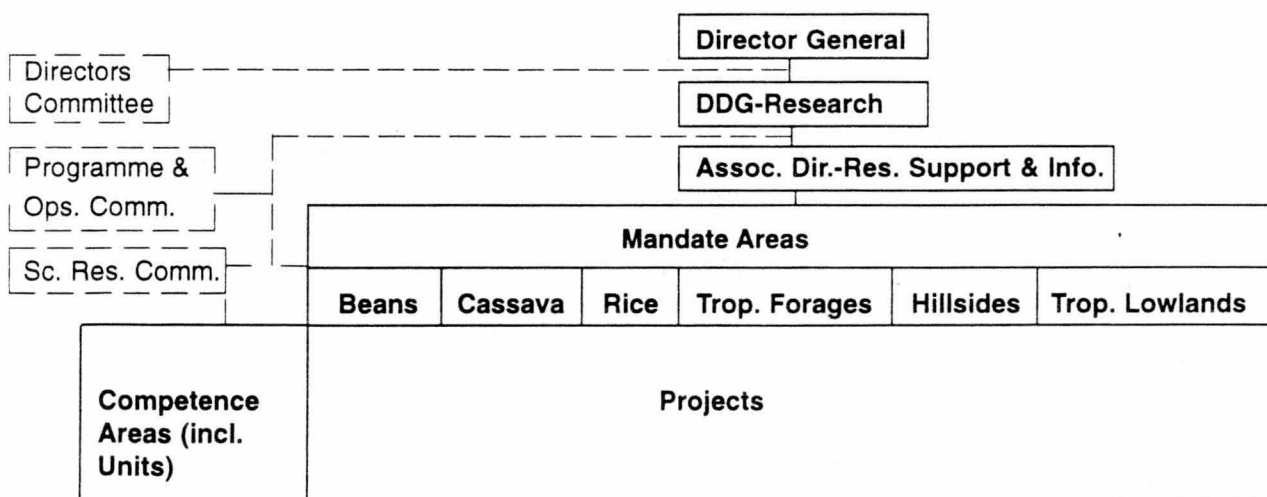


Figure 7.2. The Proposed Soft-Matrix Organization for CIAT



7.6. Project-Based Management

Consonant with CIAT's concern to improve management of research and control of resources, the Centre introduced a system of project-based management in mid-1994. Until then, all research was organized in six programmes and a restricted number of research or service units. While units functioned more or less on a project basis already, the programme subdivisions were not as clear cut.

CIAT defines a project as: "A specific set of activities or tasks that receive a fixed amount of money in a determined period of time to meet the proposed objective. An undertaking that has a beginning and an end and is carried out to meet an established goal within cost, schedule and quality guidelines." This definition of a project involves elements of both research management and financial management.

7.6.1. Use of Projects for Research Management

From the perspective of research management projects provide important advantages: 1) Goals are clearly defined, 2) Progress may be measured and evaluated, 3) An identifiable time frame enables CIAT to make decisions about the continuation or change in direction of a project in a timely fashion, and 4) Reporting to donors can be clearer and more specific.

While project management has been relatively easy to implement when considering projects under development and funded with complementary funding, its application to core programme activities has been more problematic and has resulted in attempts to define projects that range from very small to quite large. Indeed, there appears to be considerable confusion among senior staff as to what appropriately constitutes a 'project' and has led to various schemes and changing configurations.

The Panel believes that project based management is important for modern research management as it provides important insight into ongoing research during various stages. Describing CIAT's research activities on a project basis provides a convenient method for measuring performance and progress. However spending too much time in the preparation of small projects rather than on larger, more comprehensive projects of a collaborative nature would be counter productive and an inefficient use of scientists' time. The process of document preparation for reviews should not become overly burdensome.

The Panel also notes that while project based management is intended to increase accountability and improve the Centre's competitive position with donors, unfortunately it appears to have increased competition within and among programmes within CIAT. These somewhat opposing tendencies and practices, while understandable, need to be carefully balanced by a longer-term Centrewide perspective guided by strategic rather than tactical (short-term) considerations. This argument further reinforces the need for the

programme dimension of research management to be further strengthened, even as the project-based Action Plan gets implemented.

7.6.2. Use of Projects for Financial Management

Project-based management also offers some important advantages for financial management. Costs may be disaggregated and related specifically to project benefits. In launching the financial side of project-based management, the unspent portion of the 1994 budget was translated into project form in August of that year, while the full 1995 budget was presented as a collection of projects from the outset. Approximately 90 separate projects were identified, assembled into some 22 clusters of related activities. In recognition of the frequent commingling of core and complementary resources in many projects, budgets and financial reports will hereafter include both sources of funds. (A second set of documents will dissect the figures for reporting separately to the CGIAR on core, and to donors of complementary funds on their individual project segments.)

As an essential component of the process, the concept of full costing was also introduced toward the end of 1994. This involved identifying actual costs of laboratory services, space, utilities, station field usage, depreciation, and other items previously budgeted and accounted for as discrete costs. At present, the salary and benefits of senior and local staff are accounted for as budgeted, but consideration is being given to a more precise system of control. As more experience is gained with cost accounting, and as the Centre moves closer to zero-based planning, other measures of attributable cost can probably be developed. This will maximize the potential for accurate budgeting and reporting of direct as opposed to indirect (or overhead) costs. Currently (i.e. for 1994), unallocated costs amount to US\$ 6.6 million or 20% of the total budget. They include expenditures related to the Board, the offices of the DG and DDGs, the library and documentation service, communications/public affairs, financial and personnel services, the physical plant, and some aspects of research support.

In recent years, CIAT has asked donors for complementary fund to contribute 20% of direct costs for research at headquarters to cover overhead expenditures but has averaged a recovery rate of 15%. When full project costing has been implemented, it should be possible to identify and fully justify an overhead rate for inclusion in all project proposals (both core and complementary).

7.6.3. Recommendation on Project-Based Management

The last EMR emphasized the need for extensive staff consultation in budgeting. Under a system of project planning, this becomes still more important and must clearly extend to the level of individual Project Managers. It does not appear that this has been done uniformly. The Panel therefore puts forward the following recommendation:

12. The Panel recommends that management engage scientific staff in project definition and ensure that all programme heads and project leaders are fully aware of all aspects of project management and budgeting.

7.7. Leadership, Culture and Teamwork

Throughout its history, CIAT has embraced certain basic values that have become guiding principles. In their most rudimentary form these are: a concern for human dignity and welfare, and a conviction that research is essential to solving problems of world hunger. To achieve the twin goals of excellence and relevance CIAT management identified more specific characteristics that defined the CIAT culture just prior to the 1989 External Management Review. These were: "participatory management and extensive communication; delegation that implies trust, responsibility, and fairness; flexibility without a strong hierarchical overlay; and motivation based on respect for the individual." While an external cultural audit conducted at that time revealed less than unanimous agreement that all of those characteristics were present at CIAT, it also confirmed a strong endorsement by a majority of CIAT employees that most of the goals were being met.

In the five years since the last External Review, CIAT has experienced a steady erosion of its revenue, loss of its Director General, a lay-off of some 34% of its support staff, continual struggle to maintain critical mass in key areas, and a series of reorganizations. While it would be fair to say that the CIAT culture suffered during this period, it is also fair to say that the commitment to the goals of excellence and relevance remain today, as strong as ever.

New stresses were generated by the kidnapping last October of one of CIAT's staff while he was on his way to work. This incident had not yet been resolved at the time of this report. The way this situation is resolved will have an important impact not only on the individual and his family, but also on the ability of CIAT to recruit and retain staff.

In the early stages of the five year period under review the then Director General provided the leadership that led to the introduction of resource management research, and the strengthening of scientific competencies. With the reduction in funding, he began the process of downsizing.

Repeated crises in funding led to the need to take quick and often dramatic action involving difficult reductions. Both time pressures and the inevitable controversy surrounding painful decisions created an atmosphere of crisis management and a top down, authoritarian management style that has alienated a least some of the scientific staff. In the staff survey that was conducted as part of this review respondents complained about the perceived size and bureaucracy of the Research Management structure and lack of communication between Centre management and its senior research staff. The introduction of SRGs, project management and new management structures, all would have been

facilitated by greater explanation to or input from scientific staff. This would have resulted in better clarity of roles and responsibilities and made for relations of greater trust and cordiality among both management and scientific staff.

With the appointment of the Interim Director General the situation has stabilized but much remains to be done to reclaim the collegiality that most staff feel is fundamental to the CIAT culture and that must be exhibited by all senior management staff. The Panel puts forward the following recommendation:

13. The Panel recommends that, in its consideration of candidates to fill the position of Director General, the Board carefully consider the importance of a leadership style that will reintegrate the CIAT community and encourage participation in decision-making processes by programme leaders and scientists.

7.8. Headquarters and Country Operations

Nearly a quarter of CIAT senior staff are outposted to country operations. Of these 44% are in Africa with the others equally distributed between South America, Central America, the Caribbean and South East Asia. This proportion has not changed over the last five years but there is an enhanced awareness of the importance of CIAT's role in support of NARS networks. This also resulted in an ongoing change in the balance of activities within the Programmes at Headquarters, with more emphasis on collaborative work with NARS, including research into mechanisms for technology transfer and on generating natural resource management methodologies; and on developing and adapting new upstream technologies. CIAT Headquarters staff also develop germplasm for distribution by the outposted staff and directly to NARS. This service should remain an important function of the Headquarters because of the CIAT germplasm collections.

As NARS capability increases, the functions of the CIAT outposted staff will evolve into new relationships. CIAT needs to be sensitive to these changing needs. Both the task and the way it is done will change over time with more emphasis on decentralized activity away from the Headquarters buildings but backed up by the Headquarters support system. The closer working relationship with the NARS and a shared vision of joint goals will result in a more focused institutional strengthening.

Close interaction between Headquarters and Country Operations is thus fundamental to the CIAT mission. At all levels CIAT staff seek to develop a partnership rather than a dependency relationship. The style of interaction on a personal level is a very important factor in determining this outcome and there is a need for comprehensive briefing on this issue before staff are outposted. The more frequent the contacts and transparent the relationships between Headquarters and country operations the more likely they are to have a sustainable outcome. This is especially important at the Senior Management level.

CHAPTER 8 - LEGAL STATUS AND GOVERNANCE

8.1. Legal Status

Originally established in 1968 as a non-profit Colombian corporation, CIAT was recognized as a fully-fledged international organization in 1988. This status enhanced CIAT's legal presence in Colombia, guaranteeing the Centre in law the privileges and immunities essential to its work.

With the decision of Colombia to become a core donor to CIAT, an agreement was signed in July 1994 by the Centre and the Colombian Ministry of Agriculture. The 1994 agreement stipulates that, in cases where there is a direct convergence of research interests between the Colombian Government and CIAT, research planning as well as implementation will be pursued cooperatively. Chapter 6.1.1 reports on the generous contributions to CIAT/CGIAR made by the Government of Colombia.

8.2. Governance

8.2.1. Size and Composition of the Board

The CIAT Board has 17 members, including the Director General and three representatives of Colombian institutions who serve *ex-officio*. A Colombian Chair-Emeritus also attends meetings regularly. This is somewhat large by CGIAR standards, but in its review of Board size in July 1994 Board members concluded that CIAT was too broad-based in its programme to reduce the membership and noted that the host country trustees (four, at this time) are not a significant cost factor. The Panel believes that the wide Colombian participation in the Board is an important factor in the outstandingly good relations between CIAT and its host country. Currently, the Board includes two women (one is the Chair) and representatives of 11 nationalities. Members serve for three years and may be reelected once. The present Board includes members with a strong management background, and the Panel suggests that management expertise be deliberately sought in future when new members are brought in. Board membership over the last five years is shown in Table 8.1.

8.2.2. Board Operations

The Board does most of its work through committees: a) an Executive Committee including the Chair, Vice-Chair, Director General, Chairs of the Programme and of the Audit and Operations Review Committees, and other members of the Board, to reach a total of seven, including at least one member from the host country; b) a Programme Committee currently comprising nine members, c) a Nominating Committee of four

members, and d) an Audit and Operations Review Committee of six. This last is charged with reviewing both financial management and other administrative procedures, including human resources management. A CIAT staff member serves as Board Secretary.

The full Board meets annually in most years, although a second special meeting was called in 1993. Nominations and Audit and Operations Review meet once at the time of the Annual Meeting; the Programme Committee, once at the Annual Meeting and once during the Internal Programme Review; the Executive Committee, at the Annual Meeting and at least one additional time.

In the last year or so, an *ad hoc* committee concerned with resource mobilization was also established. Although its charge will now be incorporated into that of the Audit and Operations Review Committee, its formation recognized the increasingly significant role of Board members in this area. Committee meetings permit considerable give and take among members, and participation levels are high. Subsequent to the 1994 meeting, and in response to concerns expressed, the Board Chair redistributed committee assignments to equalize participation and spread the burden of reading and meetings.

The last EMR recommended that the line between the terms of reference for the Executive Committee and the Audit and Operations Review Committee be drawn more sharply. Although the issue was not settled in the interim, it was last discussed during the July 1994 meeting of the Executive Committee, and the Board Chair and Vice-Chair were charged with preparing guidelines for committees that would ensure coverage of issues and avoid duplication. One way to resolve this issue would be to assign overlapping issues to the agenda of the Executive Committee.

8.2.3. Oversight of Programme and Management

The Board receives formal information about programme and administrative developments through written reports and the CIAT Programme Committee's participation in the Internal Programme Review. This will soon be supplemented by reports from external specialists as well as data produced by the newly established internal Impact Assessment Unit. Many Board members feel that reports are too numerous and difficult to digest. The use of standard formats where appropriate, and of telecommunications systems, might help to reduce the burden on both Board members and staff.

Interaction with rank and file CIAT scientists provides important informal opportunities to get additional information. Members would like to see these opportunities increased. Additionally some Board Members seek more contact with representatives of the NARS and with CIAT's outreach programmes generally.

Participation in Board and committee meetings is full and active, especially in major policy decisions such as preparation of the Strategic Plan. Board and committee discussions and decisions are clearly recorded in excellent minutes. Members also report

that relations between Board and Management have been generally good over time and the line between the two reasonably drawn. Occasionally one side or the other has crossed the line, but this has never become a serious problem, since both have been alert to their proper roles.

8.2.4. Relationship to CGIAR Policies

Appropriate alignment with CGIAR policies is insured through staunch adherence to CIAT's Strategic Plan. The latest plan was commented upon favourably by TAC, which also specifically approved the Medium-Term Plan developed from it. The Board's persistence in measuring new project proposals against the Strategic Plan will be particularly important as CIAT engages in a strong drive to increase complementary funding substantially.

8.2.5. Retirement of Director General: Selection of Replacement

In 1994 the Director General requested a leave of absence and indicated his intention to relinquish his post at the end of his contract in February 1995. This action came amid the difficult period (amply described in other sections of this report) that saw an expansion in the scope of CIAT's programmes, and a reduction in the revenues available for them.

The Board's response to both the crisis and the resignation of the Director General has been thoughtful and well considered, with the Board Chair staying in close touch with the Centre, visiting Cali a number of times and consulting regularly with her Board colleagues. In response to Management's recommendation for the adoption of an Action Plan in April 1993, the Board requested more detailed information on the proposal's scientific impact before approving the reorganization in December 1993. With the benefit of hindsight there may have been second thoughts about the wisdom of this delay, but the decision was made with careful consideration, and represented the best judgment of the Board on the situation as known to it at that time.

At the July 1994 meeting, the Board gave substantial attention both to arrangements for interim leadership and to the search process for a permanent replacement for the Director General. The Board asked Robert Havener, former Director General of CIMMYT and current Member of the Board, to serve as Interim Director General, to ensure that the forward movement would be safeguarded.

The Board also approved the draft of a position announcement to initiate the Director General search and projected a schedule which should lead to interviews with shortlisted candidates when members reconvene in February 1995. Following the meeting, the Chair appointed a retiring member of the Board to lead a Search Committee with the assistance of two active Board members, a second retiring member, and a distinguished person external to CIAT but knowledgeable about the CGIAR. The Board Chair-Emeritus

served as an adviser on Latin American candidates. The Board asked CIAT senior staff to review and weight the qualifications sought and to suggest others. Shortlisted candidates are to present a seminar as part of the interview process. The Board's decision is to be taken shortly after this report is completed. The attention of the Board is drawn to the Panel's recommendation in Chapter 7 on the management style of the new Director General.

Table 8.1: Five-Year Record of CIAT Board Membership

Name	Country	Discipline	90/91	91/92	92/93	93/94	94/95
Beverdord, Wallace(**)	USA	Plant Breeding					X
Carlson, William	USA	Public Administration	X-NC	X-NC	X-NC		
Chapanc, Fernando(*)	Colombia	Industrial Sociology				X	
Flavell, Richard	UK	Fungal Genetics	X	X	X-PC	X-PC	
Gahamanyl, Leopold	Rwanda	Agronomy/Pedology	X	X			
Gomez, Gustavo	Colombia	Chemical Engineering				X	X
Guevara, Rubén	Honduras	Forestry					X
Havener, Robert	USA	Agriculture			X	X-RM	X
Hernández, Antonio (*)	Colombia	Economics					X
Homem de Melo, F.	Brazil	International Economics	X	X	X	X	X-NC
Hutchinson, Frederick	USA	Agronomy	X-C	X-C	X-C		
Jutzi, Samuel	Switzerland	Plant Sciences			X	X	X-PC
Kaneda, Chukichi	Japan	Plant Breeding	X	X	X	X	
Kobayashi, Masashi	Japan	Plant Breeding					X
Leonard, Jeffrey (**)	USA	Political Sciences/Economics	X	X	X		
López, Alfonso (*)	Colombia	Administration/Economics	X	X	X		
Mockus, Antanas (*)	Colombia	Mathematics/Philosophy	X	X	X		
Mukiibi, Joseph	Uganda	Plant Pathology				X	X
Nösberger, Josef	Switzerland	Crop Physiology	X-PC	X-PC			
Nores, Gustavo (*)	Argentina	Agricultural Economics	X	X	X	X	
Ocampo, José A. (*)	Colombia	Economics				X	

Name	Country	Discipline	90/91	91/92	92/93	93/94	94/95
Páramo, Guillermo (*)	Colombia	Social Sciences				X	X
Perry, Santiago (*)	Colombia	Industrial Engineering		X	X		
Ramirez, Juan M. (*)	Colombia	Law				X	
Salazar, Juan José	Colombia	Veterinary Science/Management	X-AO	X-AO	X-AO		
Samper, Armando	Colombia	Agricultural Economics	X-C-emer.	X-C-emer.	X-C-emer.	X-C-emer.	X-C-emer.
Tanner, Jack (**)	Canada	Crop Physiology	X	X	X	X	
Thrupp, Lori Ann (**)	USA	Natural Resource Management				X	X
Umaña, Alvaro (**)	Costa Rica	Environmental Engineering	X	X			
Vaccaro, Lucía de	Peru	Genetics/Int. Agr. Development	X-VC	X-C-elect	X-C	X-C	X-C
Vlek, Paul	Holland	Soil Chemistry/Plant Nutrition			X	X-NC	X
Vyas, Vijay	India	Economics	X	X	X	XVC-AO	XVC-AO
Wolfe, Martin (**)	UK	Plant Pathology			X	X	X

(*) *Ex-officio*

(**) CGIAR Nominee

C - Chair

VC - Vice Chair

PC - Chair, Programme Committee

AO - Chair, Audit and Operations Committee

NC - Chair, Nominating Committee

RM - Chair, Resource Mobilization Committee

CH-E Chairman Emeritus

CHAPTER 9 - FINANCIAL AND HUMAN RESOURCE MANAGEMENT

9.1. Budget and Finance

9.1.1. Financial Issues, 1989-1995

The review period was particularly difficult for CIAT as it coped with serious funding shortfalls. The chart below demonstrates the scope of the problem faced and the strategic decisions made, as discussed elsewhere in this report.

Table 9.1: Evolution of Resources Available to CIAT

EVOLUTION OF RESOURCES AVAILABLE TO CIAT						
<i>In constant US\$ 1994 (millions)</i>						
	1989	1990	1991	1992	1993	1994 ¹
Total resource	44.3	43.5	44.0	38.7	35.1	34.6
Core contributions	37.5	36.3	35.8	30.9	27.4	28.2
Other core income	1.1	1.1	1.7	1.4	2.5	1.6
Complementary	5.7	6.1	6.5	6.4	5.2	4.8
Allocated to:						
Capital	3.7	2.3	1.2	0.3	0.2	0.8
Mgmt. & Admin.	7.0	6.9	7.5	6.9	6.9	6.7
Instit. Develop.	5.4	4.6	4.8	3.8	3.0	2.7
Research	28.2	29.2	30.5	26.0	26.1	24.4
Beans	8.8	9.6	9.4	7.7	6.7	5.0
Cassava	3.6	4.3	5.0	4.5	4.3	3.9
Rice	2.8	3.0	2.8	2.3	2.1	1.7
Trop. Forages	5.6	5.6	5.8	3.5	3.4	2.4
Forest Margins	-	-	-	0.2	0.3	-
Hillsides	-	-	-	0.3	0.8	1.2
Trop. Lowlands	-	-	-	1.5	1.7	3.2
Research Support	4.8	4.3	4.6	3.1	3.3	2.7
Research Units	2.6	2.4	2.9	2.9	3.5	4.3
Operating Fund	-	0.5	-	1.7	(1.1)	-
International Staff	93	85	90	85	90	81
Local Staff	1562	1632	1642	1453	1364	1038

¹ Note: It is important to note that the accounting system changed in mid-1994 when many costs previously accounted for separately (e.g., laboratory services) were reallocated as direct costs to research programmes/projects. The 1994 allocation figures on the chart above deviate from the 1994 working budget in that they represent values prior to reallocation for purposes of better comparison with earlier years.

The reductions in income were largely due to a set of fluid financial circumstances in CIAT's host country. While the Colombian peso continued to decline in value vis-à-vis the U.S. dollar, from 1991 on the rate of inflation far outstripped currency gains. Adjusted to account for percentage of expenses incurred in Colombian pesos and U.S. dollars respectively, the inflation effect in the 1990-1994 period was 44%, and is expected to dictate a 7.0% increase in expenditures in 1995. The substantial costs involved in downsizing also added to the pressures experienced in this period.

CIAT recorded FY1994 contributions of US\$ 28.2 million and interest and other income of US\$ 1.6 million for a total of US\$ 29.8 million in core revenue. The books were closed in balance with US\$ 29.8 million in core expenditures, including the addition of US\$ 1.6 million to the Capital Fund. Complementary funds amounted to US\$ 4.8 million, bringing CIAT's total 1994 resources to US\$ 34.6 million. Reserve fund balances were unchanged at the end of 1994.

At the time of this review, the Centre is projecting 1995 core revenues at US\$ 27.5 million and self-generated income of US\$ 1.0 million. Complementary funds are expected to total US\$ 4.9 million. This latter figure is reduced from an initially projected figure of US\$ 7.0 million due to the transfer of several complementary projects to restricted core as approved by the CGIAR.

If CIAT's core funding in 1995 is not adjusted for the inflation experienced in 1994, the Centre will need to introduce downward adjustments in its core programme equivalent to 12.5% of its core budget, or some US\$ 3.4 million.

Staff were instructed to budget 1995 expenditures at the 1994 level plus 4%, thus leaving a projected shortfall of approximately US\$ 1.0 million. To bring core expenditures into line, the CIAT Board and Management have determined on several courses of action. Some US\$ 0.3 million will be saved via an expected core substitution effect of new special projects, and up to US\$ 0.7 million is possible via delays in recruitment of local staff and postponement of other expenditures.

As reported elsewhere, in early 1994 Centre Management initiated an intensive effort to attract additional complementary funds that would enable CIAT both to realize fully its Strategic Plan and to capitalize on the sizeable infrastructure already in place. Over the last years, complementary funds have amounted to a percentage of overall revenue ranging from 12.7% to 16.5%. The Board has clearly stipulated that projects proposed for complementary funding must adhere strictly to CIAT's Strategic Plan, a policy that warrants Management's close attention.

The Operating Fund stood at US\$ 2.9 million or 35 days of core-operating costs at the end of 1994, although no funds were added at year end. The level of this particular

reserve has fluctuated as indicated below, reflecting net operating deficits during the period in question.

Table 9.2: Status of Operating Fund

STATUS OF OPERATING FUND						
<i>In current US\$ (millions)</i>						
Year end:	1989	1990	1991	1992	1993	1994
Balance:	1.5	2.4	2.4	3.9	2.9	2.9
# days core:	14	23	24	44	36	35

In addition to the Operating Fund, CIAT ended 1994 with a Repatriation and Severance Pay Fund of US\$ 3.0 million, and thus with a total of US\$ 5.9 million in untied and loosely tied reserves. Despite the fact that the Operating Fund *per se* is smaller than the recently revised CGIAR guidelines (90 days of operating expenses), CIAT's total reserves, held in negotiable instruments with high liquidity, would cover roughly 70 days of core operations.

9.1.2. Financial Management

There is every evidence that financial management at CIAT is in competent hands. The external auditors have found little to comment on in the last years; the few recommendations of the last EMR have been attended to. Of special note is the manual to guide outposted staff in handling administrative issues, prepared following extensive consultation with them. With the manual now in its second edition, headquarters staff report a substantial reduction in problems.

Effective financial reports, now including commitments as well as expenditures, are distributed in hard copy monthly to Programme Leaders and other staff with management responsibility in various configurations (projects, project clusters, programmes; core, non-core) and quarterly to members of the Board. Staff in Cali can also access the information on line, with updates entered daily. Staff of the Project Support Office assist researchers in managing relations with project donors by assembling financial data, monitoring cash flow, arranging for audits, and soliciting written reports to meet contract requirements.

A qualified Internal Auditor and her staff keep Management and the Board informed with respect to overall administrative efficiency and compliance with policies. The Board approves her annual plan of review and Board members receive the final report. The Auditor presents periodic reports throughout the year to the DG and to other relevant staff. Emphasis is on the areas deemed of highest risk: personnel, finance, and project management. The Internal Auditor has headed the committee responsible for designing and implementing the new system of project budgeting and accounting described earlier.

9.1.3. Cash and Investment Management

9.1.3.1 Current Status

Like other Centres CIAT considers the prudent management of its funds to be an important responsibility. Investment can generate financial resources in furtherance of the Centre's mandate. Cash flow is monitored on a daily basis, so that investment opportunities can be seized at short notice. Staff of the Treasurer's office, where the responsibility lies, take advantage of a variety of sophisticated investment techniques, including arbitrage between different financial markets and instruments, occasionally using CIAT's several lines of bank credit totalling US\$ 20 million. CIAT also engages in currency hedging, based on an analysis of the exchange rate environment in relation to anticipated in- and outflows of monetary resources.

Investment decisions are made by a staff committee of five persons with financial expertise. Decisions are bound by a Board policy stipulating that CIAT "manage its financial resources within a conservative, non-speculative cash management strategy". It further defines acceptable investments as being "readily convertible fixed-yield instruments whose value to the redeemer at maturity is clearly defined". Additionally, it states that "Borrowing of financial resources shall only be undertaken when cash flow needs demand it, and/or when the Centre can safely and prudently arbitrage between different financial markets/instruments".

9.1.3.2. Assessment

CIAT's cash and investment management activities have been successful in generating additional revenue for the centre. They are monitored by the Board's Audit and Operations Committee and by the Board itself. They have been examined by both the Internal and the External Auditors. Advice is regularly sought, mainly from the banking sector in Colombia and abroad, on the general environment affecting currencies, interest rates and investment generally.

The last two years have seen unusual opportunities arising out of the relationship between the Colombian peso and the dollar, combined with wide differentials in interest rates. This situation will certainly not continue indefinitely. In the face of volatile world markets, the Panel suggests that the Board review its guidelines and definitions, with a view to ensuring that prudence is applied.

9.2. Human Resources

9.2.1. Downsizing

9.2.1.1. Staff Reductions and Critical Mass

During the past 5 years, CIAT has reduced its total work force by about 28% (from 1,644 employees in 1989 to 1,177 Dec.1994). The relative proportions of research and administrative staff have remained constant, with administrative staff averaging about 30% of total staff. However, "senior staff" have been reduced by 14% (from 93 to 80); scientific and supervisory staff by 7.5% (from 295 to 273); clerical staff by 33% (from 221 to 148); and other support staff by 35% (from 1,044 to 676). The staff reduction has been undertaken in phases - in line with the cuts in funding - and as the requirements of the Medium Term and Action Plans have become clearer over the years. The last major reduction took place in 1994. We consider this strategy of gradual downsizing appropriate.

To minimize the impact of staff reductions on the Centre's research activities, these cuts have *not* been uniform across the board: the research programmes have suffered a *smaller* percentage cut than other activities. From 1989-94, the total research staff was cut by 24% (from 855 to 647); while research support was cut by 40% (from 159 to 96), institutional development support by 54% (from 127 to 58), and management and administration by 25% (from 503 to 376). Nevertheless, it is obvious that staff cuts have been substantial in most work areas.

In terms of 'critical mass', because there are 10 fewer scientists in the research complex than in 1989, and because the number and scope of programmes and projects are largely increased, most research programmes can no longer afford to be self-sufficient in terms of full-time scientists assigned to them. Furthermore, since CIAT's mandate is broad, the Centre needs scientists from a wide range of disciplines, and this inevitably means low numbers in some programmes and disciplines. The staffing data bears this out: in late 1994, only five disciplines (genetics, agronomy, breeding, pathology and entomology) had five or more scientists; while the remaining 20 or so disciplines had only one or two scientists each. The staffing data also show that the Centre has trimmed its commodity programmes relative to the share of scientists in natural resource management research and the research Units.

9.2.1.2. Assessment and Recommendations

In the Panel's view, these adjustments have been in accordance with CIAT's strategy document. Major cuts were unavoidable, given the funding crisis, and many of the specific cuts were deliberate, to alter gradually the balance among commodity and other programmes. However, because the Centre decided to keep the 'skeletal framework' of research relatively intact (i.e. that no programme was cut in its entirety), the remaining scientific staff have naturally been stretched more thinly than before. This risks the possibility that the lack of critical mass in key programmes could compromise the quality and quantity of future research.

We also note that Management is already aware of these issues, and is intending to limit the number of projects assigned to any one individual to a maximum of 3-4; and the number of projects undertaken would also be smaller. These measures would help provide the needed senior staff - in terms of *staff-years* (SYs), not persons - in each programme and project. However, to reduce the possibility of dysfunctional fragmentation of research (and falling below "critical mass" in any particular project), it would be useful for the various programme leaders to ensure that too many projects do not chase too few scientists.

The Panel also wishes to emphasize that each programme (and scientist) should be supported by adequate numbers of well-trained and qualified scientific, supervisory and other support staff. During the past five years, the ratio of scientific support staff to senior scientists has gone *up* slightly, from 1.97 in 1989 to 2.1 in 1994. Because the cuts in other support categories have had to be larger - in order to have the required budgetary impact - this disproportionate reduction in locally-hired clerical and field workers is perceived to have reduced the productivity of some scientists. Furthermore, besides the scientific staff discussed above, the cuts in other services have also been very substantial since 1989. As noted earlier, staff cuts in research support have been about 40%, and in institutional development support about 54%. Since these services are essential for the efficient conduct of research and for its effective use and dissemination in national systems, it would be desirable that the Management review the overall staffing of research and institutional development services and, if necessary, initiate steps to gradually *rebuild* these services as additional funds become available.

Overall, regarding the strategy used for downsizing, the Panel commends CIAT's Board and Management for taking the difficult staffing decisions necessitated by the funding shortfalls, and for deliberately protecting senior research staff, to the extent possible. To ensure top Management attention to the potentially negative effects of downsizing on critical mass, we put forward the following recommendation:

14. The Panel recommends that the Operations and Programme Committee regularly monitor the adequacy of staff numbers in each research programme and discipline, and advise the DDG (Research) on any corrective measures needed. Such monitoring should cover not only the senior scientists but all other research staff as well.

We also suggest that further staffing cuts, if unavoidable, be accompanied by a more effective consultation and communication programme so that the negative impact on staff morale and productivity is minimized. The responsibility for this communication task should be shared by research leadership at all levels.

9.2.2. Personnel Management

The Director General (supported by a small international personnel administration office which reports to the DDG for Finance and Administration) is directly responsible for the personnel functions of recruitment, salary administration, performance assessment etc. for internationally recruited staff. He is assisted by *ad hoc* Selection Committees for staff recruitment, and by an Evaluation Committee composed of the four Directors (2 DDGs and 2 ADGs) who collectively review the international staff's annual assessments. The personnel management functions for locally recruited staff are undertaken by the Human Resources Department, led by the Executive Officer who reports to the DDG Finance and Administration.

Most CIAT staff are core-funded; and personnel costs as a percentage of core expenditures have increased from 62% in 1991 to 67% in 1994, despite the staff cuts discussed above, mostly due to the effects of the revaluation of the Colombian peso, and partly due to significant reductions in other expenditure categories (e.g. the cost of supplies and services has fallen from 26% of core expenditures to 22% in the same period). Based on the data assembled periodically by CIAT - mainly inter-Centre comparisons for senior staff and labour market surveys for local staff - the unit costs of internationally- and locally-recruited staff are in line with the prevailing market rates. Although the Centre has tightened its belt in response to funding shortfalls, it remains an attractive employer for most categories of staff.

9.2.2.1. International Staff - Profile

In terms of the staff profile, although the total number of scientists has gone down from 77 in 1989 to 67 in 1994, the number of scientists in the 'newer' disciplines (e.g., genetics and biotechnology etc.) has gone up from 8 to 13, and the number of specialists in resource management research has remained roughly the same (though their relative proportions have gone up) - reflecting the changing needs of the research programmes

undertaken by CIAT. The Centre employs scientists from 28 different disciplines or sub-specialties - many with only one or two scientists in each. The 'international' character of the staff profile is also evident: in 1994, the 96 'principal staff' represented 31 nationalities, with the following regional distribution: Latin America 30%, North America 27%, Europe 24%, Asia 8%, Africa 5%, and Others (Middle East, Australia etc.) 5%. The number of out-posted senior staff is at present 19, fewer than the 25 in 1989 but still a reasonable proportion of total senior staff (24%). In the future, this percentage might need to increase, given the changing research agenda and the need to strengthen collaboration with NARS and other CG centres. Almost 50% of the 74 international staff (excluding temporaries) have less than 5 years service at CIAT; about 25% have 6-10 years service; and the remaining 25% have served the Centre for 11 or more years. The gender mix of internationally recruited staff has improved somewhat since 1989, and female staff seem not to have been disproportionately targeted by the staff cuts. Voluntary turnover from CIAT has been low, despite the considerable external and internal uncertainty due to funding and organizational changes. This attests to the strong commitment of staff to the goals of the centre, and provides indirect evidence of the satisfactory conditions of employment offered by CIAT.

9.2.2.2. International Staff - Performance Management

Principal staff are recruited through a wide search process, which is transparent but not expeditious, partly due to the recent funding uncertainties. The annual performance review of principal staff is undertaken by the immediate supervisor and the latter's manager (normally the respective DDG), using a standard form. The supervisor's assessment is largely based on a review of the staff member's personal work plan; and the evaluation also covers such aspects as quality and quantity of output, publications, technical knowledge, scientific integrity, personal relations, leadership, team work etc (each of the 23 items is rated on a 7-point scale). Detailed qualitative assessments of achievements against the work plan and of overall performance are also written by the supervisor, and are commented upon by the DDG before submission of the form to the DG. These annual evaluations are then collectively reviewed by the Evaluation Committee before recommendations regarding merit-cum-annual salary increases are made. Thereafter, the DG writes to individual staff, informing them about the results of the performance review, including the annual salary increase granted.

In the Panel's view, the preparation and discussion of personal workplans provide a sound basis for the annual performance review exercise. However, some senior staff are apparently not aware of the forms used to evaluate their performance; and are thus not aware of the specific criteria used. The evaluation system also does not require the immediate supervisor to show the completed form to the staff member; and except for the general letter from the DG at the end of the process, there is little formal feedback to the employee on his/her strengths and weaknesses. Hence it appears that the performance review process is not used sufficiently for providing constructive feedback to the employee -

or for receiving suggestions on how the supervisor him/herself could contribute to further improving the staff member's productivity.

The Panel believes that the clarification of performance expectations, and provision of adequate feedback to subordinates, are vital managerial tasks and, if properly carried out, can also serve as a powerful motivational tool. Adequate discussion of the work plan and accomplishments could become even more important in the future, as the proposed matrix and project management systems get established, and each staff member (and supervisor) is held even more strictly accountable for achieving results. In addition, the need for a more systematic performance assessment system would be acutely felt when planning and evaluating the work of staff reporting to more than one supervisor or leader/manager.

Similarly, the need for the DDGs to reconcile possible differences of opinion between two or more supervisors evaluating the same individual could increase in the future; as would the role of the Evaluation Committee in ensuring consistency of assessment standards and practices across programmes and departments. The Panel therefore puts forward the following recommendation:

15. The Panel recommends that the performance assessment system be suitably modified to improve the performance planning and feedback processes used by supervisors, and to strengthen the standard-setting and monitoring roles of the DDGs and Evaluation Committee.

9.2.2.3. Locally-Recruited Staff - Accomplishments

As noted earlier, the personnel functions for locally recruited staff are undertaken by the Executive Officer and his team of specialists in the Human Resources Department (HRD). These staff have done a commendable job of avoiding major disruptions in CIAT's work while simultaneously reducing labour costs and improving the flexibility of assigning staff to various programmes and projects. In addition, major modifications in personnel policies and practices have been initiated to conform with new labour legislation - particularly Labour Law 50 and social security legislation - enacted by the Colombian Parliament in 1990.

In order to reduce costs and improve efficiency, the HRD has increased the contracting to outside agencies of such services as infrastructure maintenance and internal security, thereby eliminating many permanent positions. This elimination of jobs and downsizing of staff has been accomplished without significant legal challenge by the individuals affected or the labour Union, and at reasonable cost to the Centre in terms of retirement, severance and other payments. Furthermore, to facilitate internal mobility and selective outplacement, the HRD embarked on an intense educational programme for all staff, supplemented by special programmes targeted to staff who had voluntarily accepted

early retirement or whose services were to be involuntarily terminated. These programmes included training and personal counselling in money management for those who wished to use the lump-sum payments for starting their own business; and appear to have been successful. Membership in the labour Union has dropped from 25% of the local workforce in 1989 to 15% in 1994. We have also heard many favourable comments about the staff's high regard for the efforts made by Management to soften the blow of the staff cuts.

The Panel therefore commends senior Management and the HRD staff for managing this difficult period of downsizing rather well, and for the humane approach adopted. We note especially the close partnership that developed in recent years between the support staff and Management, and between the Director General and the Board Chair.

9.2.2.4. Locally-Recruited Staff - Future Needs

We also note that due to the significant downsizing the Centre has paid a heavy psychological price in terms of reduced motivation and increased job stress and insecurity of individual staff. There remains a discernible level of anxiety regarding the possibility of further cuts in funding and staff. In some programme areas, there is reportedly a shortage of skills; and senior scientists are complaining of having to do routine work better suited for less qualified (and less expensive) support staff. In October 1994 a high level of dissatisfaction among support staff was expressed to the Panel in a well-attended meeting with locally-recruited staff, but it is possible that the position has improved since then. To overcome some of these continuing problems, an intensified programme for rebuilding staff morale, including a systematic programme of communication, skills-upgrading, job mobility and career advancement for locally recruited staff, is desirable. This is already under consideration by the HRD staff.

9.3. Administration

9.3.1. General Administration

The general administrative functions that provide goods and services to CIAT's research operations include procurement/supplies, maintenance, food and housing, general services, legal services, field operations, and outstations - all managed by the Executive Officer (EO), reporting to the DDG Finance and Administration. In 1994, the total budget for the Sections reporting to the EO (including Human Resources) was US\$ 4.35 million. In constant 1994 dollars, this budget was 38.8% lower than the 1989 budget; and reflected a cut in staff of about 29% (from 373 staff in 1989 to 266 in 1994). In addition, as a general strategy for cost reduction and efficiency improvement, many of the administrative services previously provided in-house are now being contracted out; and service costs are being

charged directly to internal consumers, thus providing incentives for greater cost control and accountability.

The Executive Officer has also initiated programmes for re-engineering procurement, information and human resources services. This includes using new equipment and software to help improve the information and paper flow between the purchasing section, stores and the controllers office; as well as several new initiatives in the human resources area. The Panel's general assessment is that the various administrative functions are performed well at CIAT; and that the additional measures already planned will further improve the cost-effectiveness of service provision.

9.3.2. Information Systems

The CIAT five-year strategic plan, published in 1991, emphasizes the critical role information systems play in managing internal operations, supporting research activities, and communicating with research partners internationally. That plan envisages the creation of an Information Systems unit with a Director responsible for planning and coordinating information systems and services.

In October 1992 the University of Georgia in its Report on Information Management and Computer Services documented problems flowing from the "absence of established effective leadership and management of information processing technology" and recommended "that a very senior level position must be established to perform all duties related to information management, computer support services, network management, and training." Other portions of the report recommend technical upgrades and standardization most of which have been recently completed. These include the installation of a CIAT-wide fibre optic network, standardization of most hardware and software, and the establishment of a satellite link to the US that permits efficient phone, fax and Internet access.

Although the Centre has done well in the installation of hardware and software it has not yet tackled the issues of leadership and coherence. Each work domain within CIAT (GIS, finance and administration, library, genetic research, commodity improvement, to mention only a few) maintains data bases uniquely structured to its needs. There is no central listing of what CIAT has (or has access to). The Panel finds there is a need for standards that would promote easy interconnection allowing a scientist, for instance, either within or outside the system, to get a range of information from all the domains.

The Panel also believes that information policy should be clearly defined. Although 'Policies and Procedures for Senior Staff' are distributed to every staff member some scientists have expressed concern about ownership of research data, with some believing that it belongs to the scientist while others believe it belongs to the Centre.

The Panel puts forward the following recommendation:

16. The Panel recommends that a strategic plan for the development and organization of information systems in CIAT should be formulated as soon as possible, for consideration by Management and Board. The emphasis should be on establishing a coherent Centrewide system, rather than on hardware and software problems.

In preparing the plan, the University of Georgia report should be drawn upon, and other outside expertise should be sought if necessary.

Once the plan is available, and system development needs have been established, rational decisions can be taken on how far to meet CIAT's future programming requirements through contracting out, through purchasing services or off-the-shelf packages from the market, or through maintaining in-house skills for programming and systems analysis.

The Panel believes that the idea in both the 1991 strategy and the University of Georgia report of an Information Systems Unit with senior leadership is valid and should be implemented. Over the medium term, the initial cost of establishing such a unit should be more than compensated by the savings that would result from internal rationalization. In CIAT as in many other institutions the balance of interest in information systems is shifting from administrative to scientific users, and this should be appropriately recognized in the terms of reference of the unit and the reporting arrangements for its head. The Panel's recommended new structure (Chapter 7.5.1) foresees the unit reporting to the Associate Director for Research Support and Information Services. The Panel also suggests that the composition, terms of reference and reporting procedures of the Information Services Committee should be reviewed in the light of the same considerations.

CHAPTER 10 - OVERALL ASSESSMENT AND FUTURE DIRECTIONS

The Panel has completed its Review with the conviction that CIAT is a good centre which is beginning to emerge from a difficult period of change and instability. It is doing high-quality science, and showing great resilience in the face of all its problems.

The Centre took a correct decision to open up new areas of research in natural resources management. Unfortunately, its calculation that this would be fully funded by additional contributions from donors proved to be wrong. Even worse, total contributions to CIAT declined, and NRM work had to be financed by shifts out of the traditional commodity programmes which were being hit at the same time by the overall financial crisis. The resignation of the Director General was followed by the appointment of a distinguished Board Member as Interim Director General; while this ensured that there was no vacuum at the top, and helped to restore staff morale, it still left open the question of long-term leadership. Compounding these problems are increasing concerns about security in Colombia.

That CIAT is coming well through all these difficulties is due mainly to the commitment of its staff. The Panel was greatly impressed by the quality and devotion of CIAT scientists, and wishes to pay a special tribute to the Programme Leaders who have held their teams together and helped to pilot the Centre through the rough waters of the last two or three years.

Looking at the broad picture of the changes that have been introduced in CIAT, the Panel sees no reason to go back on fundamental decisions. The target balance between commodity and NRM research foreseen in the Strategic Plan (roughly 60/40) can be retained. The actual balance at present is about 70/30, but there can be no question of any further building up of NRM at the expense of the commodity programmes. The shift of resources already made could perhaps have been accomplished more gradually and with greater focus, but the pain has been absorbed and the Centre should think about the future not the past.

The greater complexity of CIAT to-day mirrors changes that have been underway not just in other international institutions but also in national systems and indeed in the world as a whole. It is to the credit of CIAT that it launched these adjustments in a proactive and visionary manner, even if serious problems arose as they were carried out.

In downsizing to cope with the financial crisis, CIAT chose to maintain a skeletal structure of commodity and NRM programmes that could be built up again as and when funding becomes available. The Panel endorses this choice, but feels that the skeletal

approach has been taken about as far as it can go. Should there be a need for further significant downsizing - and we certainly hope this will not be the case - the Centre should make a thorough review of its programmes.

The rising strength of NARS in many (though not all) countries is leading to shifts in the types of service they look to CIAT to provide. Increasingly they need an international centre, working with advanced scientific institutions in the developed world, to undertake strategic research in support of their own work. CIAT is doing well in such areas as biotechnology, virology and Geographic Information Systems. The Panel draws particular attention to the need for strategic and even basic research by CIAT and other scientific institutions on cassava and tropical forages, which are not grown in developed countries and on which a lot of fundamental information is still lacking.

CIAT has also shown initiative in adapting to the new trend towards consortia-type approaches to research, involving both traditional partners (other centres and organizations, NARS) and new actors (the private sector, NGOs). Of special interest is the creation of FLAR (described in Chapter 2.4), a mixed group of private and public sector organizations, to assume a significant level of financial responsibility for research on irrigated rice.

The Centre has participated eagerly in CGIAR Systemwide initiatives and similar undertakings. Probably individual scientists find a new challenge in this type of work. From the point of view of the Centre, however, the Panel believes it is necessary to be cautious. No less than 10 new initiatives of various types involving CIAT were started in 1994. It is imperative that CIAT organize its participation in a way that conserves enough of the time of its managers and scientists for them to handle their basic responsibilities well. The systemwide programme approach is the way of the future, and is supported by the Panel, but we hope that CIAT will not be pressed to join in too many more collaborative exercises before it has sorted out its internal problems.

Relations between CIAT and NARS have been found generally good, and in the case of the host country Colombia outstandingly so. However, there are no grounds for complacency. NARS are changing rapidly, and CIAT will have to develop new modes of interaction with them. Genuine consultation on important issues, in particular research priorities, is the name of the game. This is quite different from explaining decisions already virtually taken, or from seeking comments on programmes already drafted. There have been one or two misunderstandings with important NARS, and regular policy-level contacts between the Centre and its major clients will be advisable.

The Panel has been well satisfied with the general thrust, and the level of science, in the commodity programmes. We have put forward a number of suggestions for incremental improvements, but have found little need for formal recommendations for a change of emphasis or direction.

The Natural Resource Management Programmes are still young, although they have been able both to initiate important new research and to take over some work previously carried out by CIAT under other headings. The Panel endorses the general approach as described in Chapter 3. We feel, however, that the limited resources available call for a sharper focus through reducing the number of research sites. For the same reason we are not comfortable with the present overall organization of NRM, and have presented several options for consideration by the incoming Director General and the Board. These relate to the structuring of the work by programme, and the role of the Land Management Scientific Resources Group (which should become a programme or a unit depending on how CIAT foresees its long-term future). More broadly, work on NRM interfaces closely with socioeconomic issues at both policy and farm levels. CIAT will need to develop a clear vision on how these interfaces should be handled vis-à-vis international organizations and national offices concerned with policy. The Centre is strong in research on the interaction between small farmers and the environment, and this work should be built on.

Mounting importance is being attached in the world at large to the role of the international centres as custodians of the global heritage of germplasm. The Panel found that CIAT's Genetic Resources Unit has been without a head since the previous incumbent moved to IPGRI. We have put forward a recommendation on the profile of a new head, who should be found as soon as possible.

In the opinion of the Panel, the most immediate and important problems of CIAT relate to management rather than to science. Most of our recommendations go in this direction.

Our report has been drawn up on the eve of the selection by the Board of a new Director General. The need for inspiring long-term leadership is evident throughout the centre. Difficult times are not yet over, and the personality of the new incumbent will be a prime factor for sustaining staff morale. In the view of the Panel a participatory style of management will be essential. During the last few years a gap has opened up between middle and lower level staff on one side and senior management on the other. The pressures arising out of the financial crisis have probably forced painful decisions to be taken too quickly, and have inhibited staff consultation. Effective consultation and participation on matters affecting the research staff needs to be fully restored. While this may slow down decisions, it will mean that they are better understood, better supported, and perhaps even better formulated when they are taken.

An area where lack of consultation has led to problems has been the introduction of the SRGs. The Panel has described in Chapters 4 and 7 the confusion among staff over the SRGs' role and functions. We believe that they are developing well as vehicles for promoting interaction across programme lines. They should not, however, be regarded as a management tool, nor as part of the management structure. In fact, the Centre needs to

move in two different directions. In order to mobilize its expertise in support of system work, particularly on NRM, interdisciplinary groups are needed. On the other hand, a gradual move towards more strategic research creates a different need for disciplinary or affinity groups, that can produce a highly focused impact in a relatively narrow field.

The Panel fully backs the introduction of a project basis for research and financial management. However, the way in which this was done - without much staff consultation - led to problems which are still not fully resolved. Coming as it did in the middle of the financial crisis, the impression was created that research was becoming administration-driven, instead of administrative processes being used to promote more effective research. Whether it is right or wrong, this impression persists and will need corrective action by the incoming Director General.

In the field of human resource management, the Panel has been deeply impressed by the manner in which CIAT carried out a massive reduction in staff (affecting almost 500 employees in the last five years) without running into serious labour problems. The Panel also found every evidence that financial management at CIAT is in competent hands.

Last but not least, the Panel has been favourably impressed by the operation of the Board of Trustees.

In concluding, the Panel wishes to express the hope that the uncertainties of the present transitional period will be speedily resolved. The Centre has remained an exciting and creative place to work, despite all its recent problems. With the right leadership, and using the new modes of cooperation with other institutions and NARS, CIAT can make a significant impact during the years ahead, both in its new and in its traditional fields of research.

ACKNOWLEDGEMENTS

The Chair and Panel Members wish to express their grateful appreciation to the Board, management and staff of CIAT for their open, full and frank cooperation throughout the Review. The accommodation at CIAT was excellent and travel arrangements for visits to country programmes outstanding. Panel members felt at home both in CIAT headquarters and during the country visits.

Mr Robert Havener, Interim Director General, Dr William Scowcroft, Deputy Director General, Research and Dr Fritz Kramer, Deputy Director General, Finance and Administration, Dr Gerardo Habich, Associate Director, Institutional Relations and Dr Douglas Pachico, Associate Director, Natural Resource Management, fully cooperated with the TAC and CGIAR Secretariats throughout the Review from the planning stages to the completion of the report. Dr Habich deserves singling out as CIAT's point of contact with the Review, his willingness and flexibility in accommodating our various requests was deeply appreciated. With the need to find a replacement Panel Chair and the loss of the Panel Secretary for the main phase, all deserve our special thanks for their tolerance and understanding.

We are grateful to Ms. Ann Drummond of the TAC Secretariat for her excellent work in the typing and preparation of this report. She was most ably assisted in her task by Ms Gloria Posada, Margarita Pulgarin, Martha Reyes, Rebecca Bolaños and Vilma Ceron. We have a special word for Ms Maria Eugenia Cobo, CIAT's Coordinator of Conference Rooms. Our further thanks go to Carlos Meneses, Manuel Caldas and Carlos Alberto Ospina for keeping our machines in good order, also to Cesar Otero, David Salgado, Alcidiades Orozco and Adriano Romero for their assistance.

FOURTH EXTERNAL PROGRAMME AND MANAGEMENT REVIEW OF CIAT PANEL COMPOSITION AND BIOGRAPHICAL INFORMATION

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TERMS OF REFERENCE FOR EXTERNAL REVIEWS OF CGIAR CENTRES

BACKGROUND

The Consultative Group on International Agricultural Research (CGIAR) has charged its Technical Advisory Committee (TAC) with the responsibility of conducting External Programme Reviews (EPRs) of those International Agricultural Research Centres (Centres) that it supports financially. The CGIAR has assigned a similar responsibility to its Secretariat for External Management Reviews (EMRs).

TAC and the CGIAR Secretariat normally discharge these responsibilities by commissioning either separate panels or a joint panel to conduct the reviews. In commissioning panels, neither TAC nor the CGIAR Secretariat delegates its responsibility for reviews, but both use panels to facilitate the process. Panels submit their reports for consideration by TAC and the CGIAR Secretariat before they are transmitted to the CGIAR. While the main recommendations made by panels are normally endorsed both by TAC and the CGIAR, such endorsement cannot be presumed by either the panels or the Centre under review. Equally, as autonomous institutions, Centres are not obliged to implement the endorsed recommendations. In practice, however, they usually implement most, if not all of them.

PURPOSE

Through its support of International Centres, the CGIAR aims to contribute to increasing sustainable crop, livestock, fish and tree production in developing countries in ways that improve the nutritional level and general economic well-being of low-income people. The purpose of external reviews is to help to ensure that the Centres continue to implement strategies and programmes that are relevant to these goals; that they maintain or enhance their record of achievement; and that they are efficiently managed. In these ways, external reviews reinforce mechanisms of accountability within the System.

EPRs and EMRs are also essential components of the CGIAR's integrated planning process. The context in which they are undertaken is to be found in the document "Review Processes in the CGIAR".

THE REVIEW

Against this background, the panel is requested to make a thorough and independent appraisal of the Centre and all its activities, following the broad topics below, as well as the appended list of questions and guidelines. Panels are encouraged to set their findings in the broader context of the CGIAR System, where this is relevant to the activity or programme under review.

A. Recent Evolution of the Centre

Important changes affecting the Centre since the previous external review.

B. Mandate

The continuing appropriateness of the Centre's mandate in relation to the mission and goals of the CGIAR.

C. Strategy and Programmes

The policies and strategies of the Centre, their coherence with CGIAR strategies, and the mechanisms used for monitoring and revising them.

The extent to which the Centre's strategy is reflected in its current programmes; the rationale for any proposed changes by the Centre and their implications for future activities.

The quality of current programmes and activities.

D. Centre Guidance, Values and Culture

The overall effectiveness of the Centre's Board of Trustees in governing the Centre, and the effectiveness of leadership throughout the Centre.

The Centre's guiding values and culture, and their influence on the Centre's performance.

E. Programme Organization and Management

The mechanisms in place at the Centre to ensure the excellence of the programmes and cost-effective use of resources.

The adequacy of the Centre's organizational structure, and the mechanisms it uses to manage and coordinate its research programmes and related activities.

F. Resources and Facilities, and their Management

The financial resources available to the Centre in relation to its present and future programmes.

The land, laboratories and services available for supporting the programmes.

The Centre's human resources.

The Centre's information resources and facilities.

G. External Relationships

The Centre's relationships with national research systems ¹ in developing countries.

Collaboration with advanced institutions in research and training, in both the public and private sectors.

Collaboration with other CGIAR Centres and international agricultural research institutions, and undesirable overlap of activities.

The Centre's relationships with the government of its host country or countries and with institutions therein.

H. Achievements and Impact

The Centre's overall impact, its contribution to the achievement of the mission and goals of the CGIAR, and the methods used for making such assessments.

Recent achievements of the Centre in research and other activities.

The potential of the Centre's current and planned activities for future impact.

¹ National research systems include all those institutions in the public and private sectors, including universities, that are potentially capable of contributing to research related to the development of agriculture, forestry and fisheries.

THE REPORT AND RECOMMENDATIONS

Panels are requested to prepare succinct reports in plain language (understandable to non-technical readers), in which factual material is kept to the minimum necessary to set the conclusions in context. Reports should include clear endorsements of the Centre's activities where appropriate, as well as recommendations and suggestions for changes.

Recommendations should be justified by the analysis and approved by panel members. Recommendations for increases in staff or activities should be accompanied by analyses of their resource implications. Reports should be formally transmitted to the Chairman of TAC and the Executive Secretary of the CGIAR by panel Chairs.

LIST OF QUESTIONS FOR EXTERNAL REVIEWS

These questions supplement the Terms of Reference and illustrate the types of question the panel should consider in each category. They apply to most, but not necessarily to all CGIAR Centres. In addition, TAC and the CGIAR Secretariat usually compile a short list of questions that are specific to the Centre under review. In preparation for each review, the questions are circulated to the members of the CGIAR and the Centre inviting them to comment and, if considered essential, to add supplementary questions. The panel is not required to answer all questions explicitly, but to take them into account in making its own assessment of the most important ones.

A. Recent Evolution of the Centre

1. What important changes have taken place in the Centre since the previous external review? What were the principal reasons for change? What are the likely effects of these changes on the future performance of the Centre?
2. How responsive was the Centre to the previous review?

B. Mandate

3. How appropriate are the Centre's operational mandate and mission statement in relation to the changing mission and goals of the CGIAR?
4. How well do the present and planned activities of the Centre relate to the mandate and the mission of the Centre?

C. Strategy and Programmes

5. Does the Centre have an up-to-date and well-reasoned strategy statement? In particular, does it:
 - (a) reflect a thorough understanding of the needs of the Centre's principal clients and of the relevant activities of its partners and collaborators?
 - (b) take into account the major changes expected to occur in the Centre's external environment?
 - (c) spell out the Centre's aims and objectives in different programme areas and provide a clear justification for them?
 - (d) take into account the Centre's internal strengths and weaknesses and the financial constraints likely to be faced?
 - (e) provide a clear justification for the future scale of the Centre's operations?
6. Are national authorities satisfied with the Centre's strategy and did they have adequate opportunity to contribute to its formulation?
7. Does the Centre's allocation of resources to its programmes reflect the priorities appropriately? Are the planned directions and priorities within programmes appropriate?
8. Does the Centre's strategy sufficiently take into account the determinants of sustainable production, the alleviation of poverty and preservation of the quality of the environment?
9. Has the Centre analyzed the operational implications of its future strategy and priorities in terms of finance, staff and other aspects?
10. How well is the Centre's current strategy reflected in its programmes and activities?
11. How successful has the Centre been in reaching its major objectives in each major programme area since the previous external review? Have the approaches adopted been the most appropriate for the problems to be solved? What has been the quality of the Centre's work in each programme area?
12. How effectively does the Centre's training programme meet the needs of national research systems?

13. How much attention has the Centre paid to gender considerations in planning and implementing its programme activities? Is this adequate?
14. Does the Centre give appropriate attention to post-harvest technology?
15. Has the Centre made adequate provisions from its core funds for work on genetic resources? How effectively is this work exploited for the benefit of developing countries?

D. Centre Guidance, Values and Culture

16. Is the Centre's legal status appropriate for fulfilling its mission?
17. How effective has the Centre's board been in determining policy and providing oversight? How effective has it been in managing its internal affairs (e.g., planning, internal board structure, member selection and development, managing meetings, etc.)?
18. Are board-management relationships based on openness, respect for each other's roles, and mutual trust? Does the board regularly assess and provide feedback on the performance of the director general on the basis of explicit and objective criteria?
19. How effectively has the Centre been led by the director general and the management team since the previous external review? How well do senior managers work as a team?
20. What principal guiding philosophies appear to shape the action of the board, management and staff? Are they conducive to high performance? (Among others, consider attitudes towards creativity, accountability, efficiency, and organizational change.)
21. What are the main features of the Centre's current organizational culture? Do aspects of this culture serve as barriers to performance? Is the Centre's organizational culture in harmony with its strategy, structure and management practices?

E. Programme Organization and Management

22. Has the Centre developed an organizational structure suited to good programme performance? What coordination mechanisms are in place? Are they effective? Are there alternative structures that could serve the Centre better in the future in the light of the Centre's strategy?

23. How effectively are the Centre's decentralized activities linked with those at the headquarters? Do the staff outside the headquarters have adequate opportunities to contribute to overall planning and decision making?
24. How effective are the Centre's strategic and operational (i.e. medium term and annual) planning processes? How well are they linked to budgeting? Do these processes ensure sufficient consideration of the views of the Centre's clients and other key stakeholders?
25. Does the Centre have an effective planning and management system for projects or activities?
26. How effective are the Centre's programme monitoring and internal review systems and processes? Does the Centre have an effective peer review or a similar quality control process?
27. Do staff work effectively in teams? Do the structure and operating procedures of work-groups facilitate cooperation and teamwork?
28. Do the Centre's programme organization and management processes ensure efficiency and internal accountability? Are they conducive to innovation?

F. Resources and Facilities

29. How effective has the Centre been in organizing, staffing and managing its human, financial, administrative and information resources?

Human Resources

30. Has the Centre been able to attract and retain international and local staff of the highest calibre? Is the turnover rate one that ensures programme continuity as well as healthy infusion of new staff into programmes?
31. Does the Centre have appropriate personnel policies for international and local staff stationed at the headquarters and outside it? Are they seen to be fair and consistent? (Consider policies for staff recruitment, orientation, compensation, performance planning and assessment, career development, tenure, spouse employment, retirement, etc.)
32. Does the Centre actively promote recruitment, retention and career development of women? Are there barriers to women's advancement in the Centre?

33. How successful are managers and supervisors in managing people? In particular, how skilful are they in planning, coordinating and delegating work, communicating effectively, and motivating, developing and rewarding staff?
34. How satisfied are staff at all levels with their jobs? How are morale, trust, communication and teamwork perceived among the staff?

Finance

35. How successful has the Centre been in securing funds for its activities? How stable is the Centre's funding? Does the Centre have a fund-raising strategy, and how effectively is fund-raising managed?
36. Does the proportion of the Centre's budget received as restricted funding distort the Centre's strategy and the priorities accorded to its various activities?
37. How effective are the systems and processes used for financial management of headquarters and field operations? (Consider financial planning, analysis, reporting and control, accounting, budgeting, internal and external auditing, and cash and currency management.)
38. How strongly is financial management linked with programme management? How much financial responsibility do the programme staff have?

Administration

39. How successful has the Centre been in establishing an administrative infrastructure that meets the needs of staff in an efficient manner?
40. How cost-effective are the systems and policies used for managing the Centre's:
 - property (e.g., maintenance, development, construction, rental);
 - general services (e.g., security, housing and dormitories, food services, transport, travel services);
 - procurement operations (e.g., foreign and local purchasing, receiving, stores)?

Information

41. How successful is the Centre in acquiring, generating and managing the information it needs for decision-making, communication and integration of activities?
42. How effectively are information services and technology managed? (Consider computerization, telecommunications, records management, archives, library, and documentation.)

G. External Relationships

43. How successful has the Centre been in managing its relations with:
 - clients in developing countries;
 - institutions in the host country of its headquarters and of its substations in other countries;
 - public and private sector institutions in developed and developing countries (including other CGIAR centres);
 - donors, the CGIAR and TAC;
 - the media and the general public?
44. Is the Centre's strategy for collaboration with national research systems appropriate considering the sizes and stages of development of these systems? Are the priorities for collaborative work accorded to individual countries (in particular, the host country) appropriate? Does the Centre actively promote a strategy of collaboration in international research with national systems and regional research organizations?

H. Achievements and Impact

45. What mechanisms does the Centre have in place to monitor its achievements and impact? Are these adequate?
46. How does the need to demonstrate impact influence the Centre's priorities and strategies? Is there a tendency for long-term consideration to be sacrificed for short-term gains?
47. What have been the most notable achievements of the Centre since the previous external review?

48. What benefits have developing countries derived from the Centre's work since the previous review? What contributions has the Centre made to strengthening national research systems through training, institution building, collaborative research and technical assistance?
49. What is the Centre's potential for further impact, given its planned activities? Do these justify continued donor support for the Centre? Is there a case for increasing the Centre's funding level? Could funding be reduced without seriously affecting the Centre's potential for further impact?

ANNEX III

LIST OF INSTITUTIONS VISITED AND PERSONS MET OR CONTACTED

1. BRAZIL (10-14 October 1994)

EMBRAPA Headquarters, Brasilia

Dr. Maria Lucia d'Apice Paez, Chief of the Strategic Administration Office
Dr. Joao Batista Silva, Chief of States Systems Office
Dr. Wenceslau J. Goderte, Chief of Research and Technology Development
Dr. Sotto Pacheco Costa, Dept. of Economic Programming and Commercial Development
Dr. Fernando Antonio Araujo Campos, Dept. of Research and Development of Technology
Dr. Mario Alves Seixas, Chief of the International Cooperation Office

CIAT Office, Brasilia

Dr. Miguel Ayarza, Agropastoral Systems Specialist, Tropical Lowlands Programme

CIAT Office, Cruz das Almas

Dr. Bernardo Ospina, Training Coordinator, Cassava Programme
Dr. Stephen Lapointe, Regional Coordinator, IPM/UNDP Project, Cassava Programme

CIAT Office, Rio Branco

Dr. Michael Thung, Multi-Species Production Specialist, Tropical Lowlands Programme

CIAT Office, Planaltina

Dr. Esteban Pizarro, Agronomist, Tropical Forages Programme

EMBRAPA, Cruz das Almas

Dr. Orlando Passos, Chief, CNPMF
Dr. Wania Fukuda, Coordinator, Germplasm Project
Dr. Aristoteles Pires de Mattos, Coordinator, IPM Project
Dr. José Eduardo Carvalho Borges, Weed Scientist

CENARGEN, Brasilia

Dr. Fatima Batista, Virologist
Dr. Marco Althaff, Legumes Curator
Dr. Renata Tenente, Head of the Quarantine and Nematology area
Dr. Eduardo A Viulla Moran
Dr. Antonio Carlos Guedes, Curator Chief
Dr. Jose R. M. Valls, Researcher
Dr. Leo Roberto Costa, Curator of Roots and Tubers
Dr. Alfonso Celso Canogira Valois, Deputy Chief, Technical Areas

CPAC, Brasilia

Dr. Lourival Vilela, Pastagens/Soils
Dr. Ronaldo P. de Andrade, Pastagens/Seeds
Dr. Elinio Alves de Moraes, Native Grasslands
Dr. Maria Alice Santos Oliveira, Chief CPAC
Dr. Alexandre O. Barcellos - Pasture Management

CNPAF, Goiania

Dr. Homero Aidar, Chief of CNPAF
Dr. Maria José de O. Zimmermann, Breeder and TAC member
Dr. José Eustaquio Parmeiro
Dr. Maria José del Peloso

Porto Velho and Rio Branco

Dr. Pedro Sanchez, Ph.D, Director General, ICRAF
Dr. Carlos Castilla, Soil Scientists, ICRAF
Dr. M.L. Davies de Freitas, Consultant
Dr. Neil Turner, Chief Research Scientist, CSIRO
Dr. Dale E. Bandy, Special Projects Coordinator, ICRAF

CIAT Office, Colombia

Dr. Sam Fujisaka, Ph.D, Agricultural Anthropologist

CPAF, Rondonia and Acre

Dr. Newton Costa,

CEARA State

Signor Macilio, Technical Secretary, Ministry of Agriculture
Helio, President, Research Service (CEPACE)
Dr. José Arimatea, Researcher
Dr. Genario Marcolino Queiroz, Researcher
Dr. Nazareno Damasceno, President, Extension Service
Dr. Antonio Raimundo Dos Santos, Extension Service
Dr. Juvenal Muniz

Dr. Stenio Silva, Extension Service
Dr. Itamar Lemos, Extension Service
Dr. Walter Parente, Coordinator

2. COLOMBIA

Ministry of Agriculture, Santafé de Bogotá
Dr. Juan José Perfetti, Vice-Minister

ICA, Santafé de Bogotá
Dr. Rodrigo Artunduaga, Acting General Manager

CORPOICA, Santafé de Bogotá
Dr. Rafael Aubad López, Executive Director
Dr. Juan Jaramillo Vásquez, Assistant Subdirector
for Production Systems

CORPOICA, Carimagua
Dr. Jaime Triana Jaramillo, Director
Dr. Dario Cardenas Garcia, Médico Veterinario Zootecnista
Dr. Carlos Tobon, Médico Veterinario Zootecnista

CIPASLA, Pescador
Dr. Magnolia Hurtado, Coordinator
Dr. Helle Munk Ravnborg, Post-Doctoral Fellow, Rural Sociologist, Hillsides
Program

FIDAR, Cali
Dr. Martin Prager, Director

CIALS, Pescador
José Ignacio Roa, Agronomist
Norberto Zambrano, Assistant
Bolivar Muñoz, Assistant
Alfonso Truque, Assistant

3. COSTA RICA (11 October 1994)

CIAT
Ing. Freddy Saladin, Coordinator, the PROFRIJOL Network

Fabio Baudrit Experiment Station; Bean Research Team

Msc Oscar Acuna N., University of Costa Rica
Msc Rodolfo Araya, University of Costa Rica
Ing. Floribeth Mora, University of Costa Rica
Ing. Orlando Carrillo, National Seeds Office
Ing. Alice Zamora Z., National Production Council
Ing. Joaquin Salazar, National Production Council
Ing. Adrian Morales, Ministry of Agriculture, Ganaderia.

Ministry of Agriculture

Dr. Oscar Campos Chavarria, Vice-Minister for Agriculture
Dr. Jorge Morales, Head, Livestock Section

IICA

Dr. Carols Aquino G., General Director
Dr. Edward Salvador, Director of External Relations

CATIE

Dr. Ruben Guevara, General Director

CIAT Office, IICA Costa Rica

Dr. Pedro Argel, Agronomist, Tropical Forages Programme
Dr. Raul Moreno, Agronomist, Hillsides Programmes

4. KENYA (14-15 October 1994)

Regional Research Station, Kakamega

Dr. A.B. Orodho, Station Director
Mr. R.M. Otsyula, Bean Breeder
Mr. Sammy Ajanga, Plant Pathologist.

5. NIGERIA (16-17 October 1994)

IITA, Ibadan

Crop Improvement Division
Dr. F.M. Quin
Dr. R Asiedu
Dr. I. Ekanayala
Dr. N Quat Ng
Dr. G. Thottappiling
Dr. I.N. Kasele
Dr. S.Y.C. Ng

Dr. D Mignouna,
Dr. J.B.A. Hyte
Dr. H.A. Mendoza,
Dr. A.G.O. Dixon,
Dr. M Bokanga,
Dr. E.O. Okogblnin.

Plant Health Management Division:

Dr. N.A. Bosque-Pérez
Dr. P. Bieler, postdoc.

Resource and Crop Management Division:

Dr. R.J. Skarsky
Dr. C.O. Asinobi
Dr. A.O. Lawal
Dr. K.O. Oji
Dr. F. Nweke

6. THAILAND (14-18 October, 1994)

Kasetsart University, Bangkok

Dr Chareinsak Rojanaridpiched, Dean, Faculty of Agriculture

Department of Agriculture, Bangkok

Mr Charn Thirapon

7. UGANDA (11-13 October 1994)

NARO, Entebbe

Dr. Theresa Sengooba, Station Director and Pathologist

Dr. Fina Opio, Coordinator, Bean Programme and
Pathologist

Mr. Edmond Kikoba, Agronomist

Mrs. Beatrice Kayiwa, Breeder

Mr. Michael Ugen-Adnogu, Agronomist

Ugandan NARO Director-General and CIAT MBOT

Professor (Dr.) Joseph Mukiibi.

CIAT Scientists

Dr. Roger Kirkby, the Pan-African Coordinator
Dr. Charles Wortmann, EABRN Coordinator
Dr. Soniia David, Socioeconomist
Dr. Robin Buruchara, Plant Pathologist
Dr. Kwasi Ampofo, Entomologist
Dr. Howard Gridley, Breeder
Dr. Vas Aggarwal, Breeder
Dr. Wayne Youngquist, RESEPAC Coordinator

DOCUMENTS PROVIDED TO THE REVIEW PANEL

Documents Provided by the TAC Secretariat

Review Processes in the CGIAR, 1988.

Report of the Third External Programme Review of CIAT, 1990.

A Review of CGIAR Priorities and Strategies: 1992-1993.

A Possible Expansion of the CGIAR, 1992.

Sustainable Agricultural Production: Implications for International Agricultural Research, 1989.

CGIAR Policy on Plant Genetic Resources, 1989.

Support by the CGIAR for Work on Plant Genetic Resources: Operations and Technical Issues and their Policy Implications, 1988.

The Role of Biotechnology in the CGIAR, 1989.

Documents Provided by the CGIAR Secretariat

Report of the Third External Management Review of CIAT, 1989.

Overview of Management in the CGIAR Centres, 1990

CGIAR - The Boards of Trustees of the International Agricultural Research Centres.

Roles, Relationships and Responsibilities of Trustees of International Agricultural Research Centres, 1984.

Some Thoughts Toward Ensuring the Successful Performance of Boards in the CGIAR System, 1987.

List A. Documents provided prior to the Panel's initial briefing, October 1994.

	Prescription	Document
1.	Most recent Annual Report of the Centre.	Annual Report 1993
2.	The latest Board approved Strategic Plan of the Centre.	CIAT in the 1990 and beyond: A Strategic Plan - (with a Supplement)
3.	The latest Medium-Term Plan of the Centre.	CIAT Medium-Term Plan - Program Plans and Resource Requirements 1993-1998
4.	The latest Programme and Budget document of the Centre.	Funding Request for 1995 with the Program and Budget for 1994-1995
5.	The current organizational Chart.	CIAT Organization Chart
6.	List of the agreements with other centres and institutions on cooperative activities.	List of the agreements with other centres and institutions on cooperative activities.
7.	List of on-going and recently completed projects.	List of on-going and recently completed projects.
8.	A paper summarizing the main achievements, constraints and impacts of the programmes of the Centre during the previous five years.	External Program Review: Recent evolution of CIAT and Perspectives for the future.
9.	Summary of actions taken in response to the last External Management and Programme Reviews.	External Program Review - October 1994

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- List B. Documents provided to all Panel members, at the time of the Panel's initial visit in October 1994; unless specified as:
 (m) - to management specialist only
 (o) - only one set of documents required
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1. Staff list with summary of qualifications.
 2. Table summarizing staffing pattern, with the number of staff in each category per programme and location for the current year, and an indication of the male: female ratio in each staff category.
 3. A list of staff publications during the period under review.
 4. Reports of major planning conferences, internal reviews, expert meetings, etc., which have had a major influence on the direction of the specific programmes of the Centre.
 5. Charter and other basic documents establishing the Centre, along with subsequent amendments.
 6. A paper describing the evolution of the mandate of the Centre over the years.
 7. Table showing composition of the Board over the last five years, along with an indication of the term of office of current members and their roles on the Board.
 8. The Board handbook (2 copies)
 9. Set of minutes covering Board and Board committee meetings since the last External Review (and reports of Board committees to the full Board if not included in the minutes. (o))
 10. Description of the internal management structure, including the composition and terms of reference of each committee.
 11. Set of minutes of the meetings of the Director General's management committee covering the period since the last External Review. (o)
 12. Staff manual or a description of current personnel procedures for international and locally-recruited staff.
 13. Table showing allowances, benefits, and salary ranges for each category of staff. (m)
 14. Local compensation surveys used by the Centre. (o)
 15. Table showing personal data on internationally recruited staff by programme, including each job title, incumbent's location, period of tenure, gender, nationality, age, salary over the last three years, and source of funding. (Names to be excluded) (m)

16. Table summarizing turnover of staff over the last five years by staff category. (m)
 17. List of international staff vacancies and how long positions have been vacant. (m)
 18. Reports of external auditors, including management letters, and financial officer's reports to the Board since the last External Review. (o)
 19. Most recent internal audit reports. (o)
 20. Internal management reports or reports written by consultants on aspects of the Centre's management that are of a non-confidential nature. (m)
 21. Brief description of the Centre's: (m)
 - management information systems and procedures,
 - library and documentation systems,
 - archives and records management systems,
 - computer and information technology systems and procedures.
 22. Summary information on each administrative and finance unit to be prepared in the attached format. (m)
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List C. Documents provided during the main phase January-February 1995.

1. Summaries and Updates of Systemwide and Inter-Centre Initiatives Involving CIAT - February, 1995.
 2. CIAT's Coordination and Involvement in Regional and International Networks
 3. Supplement A: Program and Budget for 1994-1995 and Funding Request for 1995 - Areas of Competence.
 4. Supplement B: Program and Budget for 1994-1995 and Funding Request for 1995 - CIAT Projects in the Pipeline and New Project Ideas.
 5. A CIAT guide to project identification, design, approval, and administration.
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**ASSESSMENT OF CIAT'S RESPONSE TO THE RECOMMENDATIONS OF THE
1990 EXTERNAL PROGRAMME REVIEW (EPR)**

The 1990 External Programme Review (EPR) of CIAT made 25 recommendations. CIAT's response to these recommendations has been taken into account in the appropriate sections of the Report. The Review Panel's assessment of the Centre's response is summarized in this Annex.

I. EPR RECOMMENDATIONS

Recommendations	CIAT's 1994 Progress Report	Panel's Comments	Implemented
<p>1. That a greater effort should be made in the Bean Program, with the GRU, to increase germplasm screening activities and to speed up the processing of backlogged materials.</p>	<p>In 1989 there was about 25,800 accessions in the Phaseolus collection and about 9,000 accessions held in backlog. After review, the backlog was reduced to some 5,000 accessions.</p> <p>In the period 1990-1994, the GRU received 1,545 new accessions which were selectively introduced. Between the Bogota facility and greenhouses in CIAT, a total of 2,225 accessions of Phaseolus were processed.</p> <p>Total accessions pending analysis are now 4,500. As to screening of germplasm, more than 20,000 accessions have been evaluated for several important diseases.</p>	<p>The Centre has achieved a significant increase in screening activity and in the processing of the backlog of materials.</p>	<p>Full</p>

Recommendations	CIAT's 1994 Progress Report	Panel's Comments	Implemented
<p>2. That CIAT take steps to assemble information on the occurrence and distribution of major constraints to bean production in Africa.</p>	<p>The Bean Programme completed an extensive survey of constraints for production regions in Africa. The survey includes definition of production environments based on edaphic and climatic data and extensive information on cropping practices.</p> <p>Estimates of importance were stratified by major regions to provide researchers with a more strategic view of constraints. The information is being made freely available to NARS and other institutions through the publication 'African bean production environments: their definition, characteristics and constraints'.</p>	<p>The Panel commends CIAT for its work in identifying constraints on bean production in Africa. It believes the survey information on soil conditions, including soil quality, will need strengthening.</p>	<p>Full</p>
<p>3. That the Rice Programme pursue more actively the use of population improvement methodologies like recurrent selection.</p>	<p>CIAT agrees, as evidenced by the fact that the Rice Programme recently recruited a breeder with such an expertise. The Programme has also developed male sterile lines for recurrent selection in the uplands and is transferring this character to the irrigated lines.</p>	<p>A recurrent selection programme to increase the yield potential of lowland rice started in 1993. Several gene pools created by CIRAD and EMBRAPA are being evaluated.</p>	<p>Full</p>

Recommendations	CIAT's 1994 Progress Report	Panel's Comments	Implemented
<p>4. That, since the yield trials have frequently shown rather poor statistical precision, the Programme make a serious effort to explore the reasons.</p>	<p>The Programme has responded by increasing the size of its experimental plots, the number of replications and the sampling methodology.</p> <p>From 1990 onward bigger plot sizes were used and the observed CV in the yield and agronomics trials were around 15 to 20%, considered acceptable to detect the differences between treatments.</p>	<p>Finds the CV's mentioned adequate.</p>	<p>Full</p>

Recommendations	CIAT's 1994 Progress Report	Panel's Comments	Implemented
<p>5. That the GRU should intensify the effort to have experts decide on a manageable core collection consisting of a limited number of accessions that contain an appropriate amount of genetic variability.</p>	<p>CIAT agrees on the need to create core collections. At the moment, however, consensus within the scientific community as to what precisely constitutes such a grouping is lacking.</p> <p>By 1994 a core collection of <i>Phaseolus vulgaris</i> has been compiled based upon a model combining historical, morphological and agroecological data.</p> <p>The world collection of <i>Manihot esculenta</i>, maintained at CIAT, consists of over 5,000 accessions representing the diversity of nearly all cassava producing countries of the world. Experience with the seven agroecological zones established to orient cassava research, and parameters of geographic origin, morphological diversity and isozyme patterns, were used to define a core collection of cultivated cassava.</p>	<p>A first step has been taken to create core collections based on agroecological zoning and passport data.</p>	<p>Full</p>

Recommendations	CIAT's 1994 Progress Report	Panel's Comments	Implemented
<p>6. That, considering the increased activities necessary for the tropical pastures and cassava collections and its great genetic variability, CIAT seek resources for adequate staffing for the Genetic Resources Unit.</p>	<p>The Head of the GRU who resigned in late 1992 has not yet been replaced because of budget cuts. The Programme Committee of the Board of Trustees in 1994 also urges that this anomaly be addressed. Recruitment for this position will be initiated in the first quarter of 1995.</p> <p>In 1994 in a joint effort between CIAT and IPGRI, a senior scientist on genetic diversity was appointed in order to provide input and coordinate the development of a Latin American consortium on plant genetic resources and agrobiodiversity.</p>	<p>Given the widening interest in genetic resources and the progress of the Convention on Biological Diversity the Panel is concerned at the delay in filling this post.</p>	<p>No</p>

Recommendations	CIAT's 1994 Progress Report	Panel's Comments	Implemented
<p>7. That CIAT considers duplication of the collection and the maintenance of a collection of sexual cassava seeds, as insurance against the possible loss of the living cassava collection maintained in tissue culture.</p>	<p>True seed does not appear to be a viable mechanism of safe duplication, as a large proportion of the collection does not produce seed under the conditions of its field maintenance.</p> <p>Two candidate institutes, FCRI in Thailand, and EMBRAPA, Brazil, have been identified as recipients of safety duplicates of the living cassava collection. Negotiations are beginning with FCRI, but the issue of financial support has prevented a commitment from EMBRAPA.</p> <p>A project is being prepared for funds to continue research in cryopreservation of cassava at CIAT in collaboration with ORSTOM, France.</p>	<p>Cryopreservation and the duplication of the Cassava collection still merits greater attention. There are promising CIAT initiatives with Thailand.</p>	<p>Partial</p>
<p>8. That even greater efforts be made to find special funds and other resources to allow the BRU to expand.</p>	<p>Seeking special project funding to carry out on priority topics is a continuous effort of the BRU. As a result the amount of complementary funds for the BRU in the last two years has equalled the funds allocated from CIAT core.</p>	<p>The Panel commends the BRU for its success in attracting extra funding.</p>	<p>Full</p>

Recommendations	CIAT's 1994 Progress Report	Panel's Comments	Implemented
9. That an internal biosafety committee be established very quickly.	A CIAT Institutional Biosafety Committee was established in 1990-91; and the CIAT Biosafety Guidelines were approved by the BoT in 1991.	The Panel emphasises the need for greater biosafety greenhouse capacity.	Full
10. That CIAT management give greater attention to clarifying the role and future responsibilities of the AESU.	The resources of the unit were incorporated in the newly formed Land Use Programme. A new agenda of research was developed covering aspects of land use in resource management research. The support services previously provided to the commodity programmes by the AESU were continued under the mandate of the new programme.	The Panel urges the Centre to decide whether the Land Management SRG should be a programme or a unit.	Partial
11. Increased attention to the needs of programme experiments in decisions on commercial cropping by Station Operations.	The Field Operations Unit gives priority to all the services requested by the programmes or to research from the point of view of the land preparation, planting, cultural labours, irrigation, etc. No services are given to the commercial production if the same have to be provided to research.	Research needs are given the highest priority but better interaction between the Programs and station operations is still needed.	Full

Recommendations	CIAT's 1994 Progress Report	Panel's Comments	Implemented
<p>12. Integrated strategies across CGIAR Centres in dealing with national programmes, particularly in non-mandate specific activities such as management training, on-farm research and networking, and in areas of overlapping mandate such as the maize/bean intercropping so important in Latin America, the Caribbean and Africa.</p>	<p>CIAT had already initiated such efforts as shown by the agronomy trials training course held in Ethiopia in conjunction with CIMMYT, the joint training courses on grain legume research held in Africa in conjunction with IITA, and the Central America regional training programme in on-farm research (also with CIMMYT).</p>	<p>Much progress has been made in the coordination of inter-centre activities. The new emphasis in the CGIAR will ensure this progress continues.</p>	<p>Full</p>
<p>13. Being selective in responding to the broad range of demands that have come out of NARS consultations.</p>	<p>CIAT agrees that it cannot respond equally to all requests or suggestions that result from our constant interaction with NARS. It needs to strike a balance between being responsive and saying "no" when appropriate.</p>	<p>CIAT has made progress in evolving a transparent priority setting process. The move towards regional groups of NARS will bring clearer articulation of regional needs which will help CIAT respond more effectively</p>	<p>Full</p>

Recommendations	CIAT's 1994 Progress Report	Panel's Comments	Implemented
<p>14. That, commending CIAT's effective development of the steering committee model and network activities in Africa and Latin America, the Centre continue its support for these efforts.</p>	<p>The Steering Committee remains the crucial management entity that oversees both research and training activities undertaken within regional networks. In some regions, the coordination of the network is being assumed by national scientists, with increasing emphasis on the identification of scientists as regional leaders in specific disciplines.</p>	<p>The transfer of network management to NARS remains CIAT policy and practice. NARS have complained that downsizing has led to devolution sometimes being accompanied by the withdrawal of technical support.</p>	<p>Full</p>

Recommendations	CIAT's 1994 Progress Report	Panel's Comments	Implemented
<p>15. That in view of CIAT's success in working out a model for collaboration with EMBRAPA in Brazil, in cooperation with IITA, in relation to the Cassava Programme for the semiarid parts of Africa, the Centre continue to work toward similar outreach plans with highly developed national systems.</p>	<p>In 1990 a 5-year project (financed by IFAD, Rome, Italy) was initiated in cooperation with EMBRAPA and IITA for the development of cassava, germplasm for semiarid and subtropical ecosystems.</p> <p>The cassava Programme is currently preparing a proposal for extending and expanding these activities in Africa, northeastern Brazil and the northern coast of Colombia.</p> <p>During 1992/93 two projects were initiated and financed by non-core resources. These two projects are: a) an integrated soil/crop management project in Southeast Asia funded by the Sasakawa Foundation of Japan; b) an integrated pest management project in northeastern Brazil (EMBRAPA) and Africa (IITA) funded by UNDP. These projects are now fully implemented.</p>	<p>The Centre is continuing to implement this policy effectively.</p>	<p>Full</p>

Recommendations	CIAT's 1994 Progress Report	Panel's Comments	Implemented
16. That CIAT headquarters reinforce the efforts of its staff in Africa for inter-centre collaboration in training and research.	Wide Inter-Centre collaboration in evolving in Africa in both research and training. Training is coordinated across all centres, with ICRAF and IITA leading this initiative.	IITA and ICRAF lead efforts to fully integrate CGIAR Centres training schedules in Africa. In 1994 an integrated across Centre training programme was published.	Full
17. That CIAT pool its knowledge and experience with others, including ISNAR, for the training of research managers.	CIAT recently contributed its unique experience in the development of teams of trainers to jointly implement a training programme in research management with ISNAR.	The Panel commend CIAT for collaborating in this inter centre initiative.	Full
18. CIAT contact with other Centres for an integrated approach on sustainability.	A number of Inter-Centre activities in the sustainable improvement of productivity have materialized over the last 3 years following the CIAT initiative. CIAT is involved in three of these; a) Alternatives to Slash and Burn; b) A Central American Consortium for Research in Hillside Areas; c) with CIMMYT in agropastoral systems in the savannahs.	Since the last EPR there has been a wave of initiatives in the sustainable improvement of productivity. CIAT has been an innovator in convening and implementing these with a range of partners.	Full

Recommendations	CIAT's 1994 Progress Report	Panel's Comments	Implemented
<p>19. That CIAT systematize its ongoing inventory of national programme training needs and its schedule for filling them. This will require consultation not just with leaders in <u>commodity</u> research programmes but with <u>national</u> research leaders.</p>	<p>In the training-the-trainers project, needs were assessed with national leaders. All training requests are submitted by national leaders (even though) the candidates may be identified by CIAT staff).</p>	<p>CIAT has made significant efforts to consult national leaders, particularly after training slumped in 1992. Training is likely to be back to pre crisis levels in 1995.</p>	<p>Full</p>
<p>20. That CIAT explore ways to get wider awareness and greater use of its SINFOC commodity collections and other bibliographic resources.</p>	<p>In the period 1989-1994, the Information and Documentation Unit has made a major investment in emerging technologies in order to promote wider awareness and greater use of its bibliographic resources, as well as to streamline operations.</p> <p>Automation of the collections and adherence to international bibliographic standards has made it easy and feasible to share CIAT's databases with partners and clients in a variety of forms.</p>	<p>The Panel commends the Information and Documentation Unit on its success in expanding operations on a reduced budget.</p>	<p>Full</p>

Recommendations	CIAT's 1994 Progress Report	Panel's Comments	Implemented
21. Attention to the balance between demand for services from the publication programme and resources available for it.	Despite a 25% staff reduction, CIAT has at least maintained its prior level of scientific publication and increased public awareness communication by many times. We have started bringing in journalism students, who do their 6-month internship working on Spanish publications, and may bring English-language interns in the future.	No additional comments.	Full
22. Careful analysis of policies for pricing publications and other CIAT materials to make sure they accomplish the desired distribution.	A Publications Advisory Committee was established in 1992. Its purpose is to screen publication proposals and set publication policy. A pricing policy was established whereby CIAT recovers manufacture and distribution expenses from book sales in developing countries. That price is multiplied by 2.5 times for sales in developed countries. Thus, the developed country sales subsidize distribution in developing countries. There is no lack of funds for publishing future books.	This strategy seems to have been eminently successful and offers another example of innovative policies in the Communications Unit.	Full

Note: Recommendations 23, 24 and 25 of the 1989 EPR Report are repeated in the EMR Report and are dealt with as numbers 2, 3 and 4 in the next table with the 1989 EMR recommendations.

**ASSESSMENT OF CIAT'S RESPONSE TO THE RECOMMENDATIONS OF THE
1989 EXTERNAL MANAGEMENT REVIEW (EMR)**

The 1989 External Management Review of CIAT made 12 recommendations. The Review Panel's assessment of the Centre's response is summarized in this Annex.

II. EMR RECOMMENDATIONS

Recommendations	CIAT's 1994 Progress Report	Panel's Comments	Implemented
<p>1. That the line between the terms of reference of the Executive Committee and the Audit and Operations Review Committee be drawn more sharply.</p>	<p>The issue was last considered at the meeting of the Executive Committee in July 1994, where "it was agreed that agendas must be set (for the meetings of the two committees under consideration) and the meetings managed in such a way as to ensure correct coverage of the necessary issues while avoiding duplication of efforts.</p>	<p>The issue has been addressed by the Centre in July 1994. Further clarity is required in the respective Terms of Reference.</p>	<p>Partial</p>

Recommendations	CIAT's 1994 Progress Report	Panel's Comments	Implemented
<p>2. That top management at CIAT be redefined to incorporate the third level in the hierarchy (the Programme Leaders) and that a Management Committee be established, to be chaired by the Director General and to meet regularly and frequently, with an advance agenda and formal minutes recorded.</p>	<p>Top management is being defined as the Director General, the DDG-Research, the DDG-F&A, the Associate Director-Resource Management Research, and the Associate Director-Institutional Relations.</p> <p>With the implementation of the Action Plan, and the concomitant move away from a strictly hierarchical organization, communications between different organizational layers have greatly improved.</p>	<p>Management and committee structures have changed since the last review. The Director's Committee, chaired by the Director General meets regularly. However the other committees, involving the Programme Leaders, meet less often. Communication between top management and Programme Leaders and scientists still needs improvement.</p>	<p>Partial</p>
<p>3. That the incoming Director General, in consultation with the Board of Trustees, evaluate the current structure in the light of the criteria listed in Chapters 6 and 3, respectively, of the External Programme and Management Review Reports.</p>	<p>With the series of redefinitions of objectives and workplans since the last review, concomitant adjustments in the organizational structure have taken place. The DG will continue to evaluate organizational adjustments in light of future development and - in close coordination with the Board - adjust the organizational structure to the needs of the Centre.</p>	<p>The "Soft Matrix" structure was introduced in 1994, together with the Scientific Resource Groups (SRG's). The role of the SRG's still needs clarification for scientists. The structure merits further review.</p>	<p>Partial</p>

Recommendations	CIAT's 1994 Progress Report	Panel's Comments	Implemented
<p>4. That CIAT appoint a Coordinator of Research Support to supervise the work of CIAT's advanced biology units as well as all other research services in the interim.</p>	<p>CIAT is in agreement with this recommendation. A GAS-level position was included in the budget (currently vacant). The area of research services is once again under review.</p>	<p>This change, although accepted, has not been implemented. The Panel is recommending a revision of structure which again includes this position.</p>	<p>Partial</p>
<p>5. That the budgeting process be revised to include consultation on all aspects of the budget, including staffing patterns and costs, with those who will have the responsibility for budget implementation, down to the level of each cost centre.</p>	<p>With the implementation of the Action Plan, with its emphasis on project planning and project execution, the budgeting process now is involving one further level: the project leader/project team.</p>	<p>Greater participation by scientists in revising the project proposal system seems essential.</p>	<p>Partial</p>

Recommendations	CIAT's 1994 Progress Report	Panel's Comments	Implemented
<p>6. That Management pursue vigorously the assessment of needs in the area of staff training and career development, design a more systematic set of policies to respond to the identified needs, and commit adequate resources to assure their realization.</p>	<p>In terms of support staff training, as a result of the EMR recommendation CIAT restructured its Human Resources Department to allow it to engage in increased activities in the areas of training needs assessment and identification of training opportunities and/or the organization of training programmes.</p> <p>In the area of career development, CIAT strongly feels that it is not the responsibility of an IARC to provide for career development for its support staff beyond (a) its own needs, and (b) providing a maximum of encouragement to pursue career development opportunities at the personal level.</p>	<p>The Human Resources Department has improved its work in local staff training. Career development would have been difficult in the context of the heavy downsizing of the past few years.</p>	<p>Full</p>
<p>7. That all first-line supervisors be trained in financial management as is relevant to their assignments as well as in supervisory skills.</p>	<p>CIAT has made budgetary and organizational provisions for the creation of an internal capacity to provide training in the effective administration of financial and other resources (including, especially, human resources). However, funding uncertainties continued to retard the implementation of these provisions.</p>	<p>The Panel understands the financial exigencies of the Centre. However it remains essential that first line supervisors become more cost-conscious and receive further training in supervisory skills.</p>	<p>No</p>

Recommendations	CIAT's 1994 Progress Report	Panel's Comments	Implemented
<p>8. That CIAT seek or help identify funding for and recruit well qualified Masters and Ph.D candidates to conduct their dissertation research under the supervision of CIAT Senior Staff scientists.</p>	<p>To the extent that M.Sc. and Ph.D students can be enlisted for the task of availing themselves of such data and including them in their dissertations and publications related to their dissertations, CIAT will make every attempt to follow this suggestion.</p>	<p>The number of Ph.D trainees has doubled since the time of the last review. The Panel is satisfied that the Centre is seeking to implement this recommendation.</p>	<p>Full</p>
<p>9. That CIAT design and implement a system of individual performance planning and evaluation.</p>	<p>The first step towards the realization of this goal was a commitment to this concept by Management, including the redefinition of the evaluation process of principal staff. The recent changeover from a programme orientation to a project orientation should further be conducive to individual performance planning and evaluation.</p>	<p>The Panel believes that substantial improvement is still needed in this area.</p>	<p>Partial</p>

Recommendations	CIAT's 1994 Progress Report	Panel's Comments	Implemented
10. That CIAT continue to place a high priority on the development of administrative systems and procedures which will be more appropriate to the needs and circumstances of its outposted staff.	CIAT restructured the organization of outposted projects based on two precepts. Firstly, for each project, a plan was drawn up for the building up of a local provision of administrative and accounting services. Secondly, the area of finance and administration at CIAT headquarters assumed primary responsibility for extending its realm of influence and supervision to the administrative/financial operations of outposted projects.	The administrative systems both at CIAT headquarters and in outstations have improved substantially.	Full
11. That CIAT pursue a policy of maintaining its working capital fund at a level equal to 30 days of expenditures (approximately three million dollars in 1989).	By 1994, fund balances kept in liquid form had increased to a level equal to 90 days of expenditures. CIAT pursued a series of avenues, including the creation of an endowment, debt-swap mechanisms, donations from private business and philanthropists, and income from patents and services.	Financial management systems have been strengthened; the level of the working capital fund needs to be continuously monitored.	Full
12. That the CGIAR Secretariat and the Centres jointly agree on a set of Systemwide policies which would guide the Centre's debt swap operations.	At this stage, debt swap opportunities have lost all appeal and no longer constitute a promising avenue for funding.	The Panel shares the Centre's views on debt swap opportunities. A System wide policy on investment more generally would be valuable.	Full

LIST OF SYSTEMWIDE INITIATIVES AND CIAT NETWORKS

SYSTEMWIDE INITIATIVES

Systemwide Soil, Water and Nutrient Management Initiative

At the New Delhi Mid-Term CGIAR meeting in May 1994, IBSRAM (International Board for Soils Research and Management, a non-CG centre) presented a document on soil, water and nutrient management (SWNM) (Greenland et al.). At the same meeting CIAT was proposed as the 'focal' centre for this possible initiative for the CG system. CIAT accepted this role.

CIAT and IBSRAM are to co-convene this initiative and will prepare a position paper with a strategy for project proposal preparation and project outlines for submission firstly, to TAC, by the end of February 1995, to the CG Mid-Term meeting and finally to the ICW95 with the aim of securing funding from the 1996 CGIAR budget. CIAT will need to establish a secretariat to fulfil its functions as convening CG centre and plans are underway to utilize some of the above mentioned funds for this purpose.

Management of Acid Soils (MAS)

Management of Acid Soils (MAS) is a regional consortium established in 1994 for the generation of technologies for enhancing and sustaining agricultural production on the low fertility, generally acid soils of Latin America, which are prone to degradation. The main institutions involved in the consortium include NARS, a regional centre, ORSTOM, France, universities from developing and developed countries and ICRAF.

No separate funding is yet available for MAS activities and CIAT currently bears the cost of the MAS secretariat in terms of materials and manpower (mainly from the budget of the PSSM-SRG). The MAS theme has now been incorporated into the CGIAR systemwide initiative on SWNM.

Systemwide Genetic Resources Programme

In 1994 the Centre Directors set up a Systemwide Genetic Resources Program (SGRP) comprising independently-managed Centre GRUs, with a convener Centre (IPGRI). It will catalyze the IARC's involvement in the emerging global genetic resources (GR) system. The Inter-Centre Working Group on Genetic Resources (ICWG-GR) is the main advisory body of the Program. The DDG-Research as the Chair of CIAT's Standing Committee on Genetic Resources, has been actively involved in the initiative.

An internally commissioned external review of the CGIAR genebank operations will take place in 1995-96. The outcome of this review should help CIAT's case for funding for the GRU and a wider role in LAC.

Forage Genetics Resources Network

Under the umbrella of the Systemwide Genetic Resources Programme, CIAT invited several IARCs and NARS Forage Genetic Resources Centres to a workshop in April 1994 to discuss closer interaction among Centres holding tropical and subtropical forage germplasm and the procedure for setting up a formal network. Institutions attending were CENARGEN (Brazil), CIAT, CSIRO-ATFGRC (Australian Tropical Forages Genetic Resources Centre), ILCA and IPGRI.

Strategic Alliance for the Conservation and Sustainable Use of Agrobiodiversity in LAC

This is a CIAT 1994 proposal, also under the umbrella of the Systemwide Initiative on Genetic Resources, to establish a strategic alliance of these institutions to better understand, conserve and sustainably utilize their agricultural biodiversity resources. The Inter-Centre Working Group on Genetic Resources endorsed CIAT as the lead centre to implement the proposal, and under the Systemwide Initiative on Genetic Resources, the Group approved an allocation of US\$ 30,000 to conduct a planning workshop.

CIAT expects representation of NARS and universities of Mexico, Costa Rica, Colombia, Peru and Brazil, the PROCIs of IICA, and COPRA (Smithsonian Institute) together with the Latin America based IARCs (CIAT, CIMMYT, CIP and IPGRI).

Systemwide Livestock Initiative

An integrated approach to livestock feed resources production will be the initial thrust of this initiative which was launched with the establishment of ILRAD in January 1995. US \$0.05 m has been approved by TAC for the preparation of the initiative. CIAT will be collaborating, particularly through the Tropical Forages Programme.

Integrated Pest Management Network (An Inter-Centre Initiative)

The 'IPM Network' was approved at ICW'94 and IITA was designated the convenor centre. CIAT is represented in the network by the Pest and Disease Management

SRG which is organizing meetings with some LAC NARS to formulate joint IPM projects to be presented there.

Seeds of Hope (An Inter-Centre Initiative)

Starting in early 1994 the CGIAR centres have pooled technical expertise and in collaboration with NARS in neighbouring countries have responded, to the critical need to restore crop production and biodiversity. They are: CIAT (beans), CIP (sweet potato, potato), ICRISAT (sorghum), CIMMYT (maize), IITA (cassava), IPGRI (genetic resources). CIAT is coordinating the initiative. The budget for July 1994 through December 1995 is US\$ 1,071,000, of which US\$ 350,000 go to CIAT. The sponsors of Seeds of Hope are USAID, ODA, SDC, AIDAB, IDRC and World Vision. In addition the CG centres will provide in-kind resources of US\$ 800,000.

Integrated Pest Management Network

The IPM Network was approved at ICW 1994 and IITA was designated the convenor centre. The CIAT Pest and Disease Management SRG is preparing to participate in network meetings and is organising meetings with NARS' representatives to formulate joint IPM projects to be presented to the networks.

Water Management Initiative

TAC has recommended this initiative, with IIMI as the convening Centre, recommending US\$ 1.0 million for proposal preparation and coordination, and seed funding of approved research thrusts. Activities under four heads will begin in 1995.

- 1) Future scenarios on water supply for agriculture (IFPRI, IIMI and FAO).
- 2) Efficient water use and food supply:
 - a) Increasing the efficiency of irrigation water use (IRRI, WARDA, ICARDA, CIMMYT, CIAT, ICRISAT, IBSRAM, IIMI, ICID);
 - b) Increasing water use efficiency for crop production (same group of institutions); and
 - c) Improving water resources use in livestock production (ICARDA, ILRI and IIMI).

- 3) Environment:
 - a) Conservation of water resources (ICRAF, CIFOR, ICIMOD, ICARDA, IRRI, CIAT, IIMI, IBSRAM, IUCN, UNEP, ICLARM); and
 - b) Climate change and effect on water resources (IRRI, UNEP, WMO, IIMI).
- 4) Policy and institutions (IFPRI, IIMI, WB, FAO, ICRISAT, ISNAR, IWRA, ICID, UNDP, UNEP, Indiana University).

Systemwide Information Resources Initiative

All of the CG centres will potentially be involved in this initiative. Fifteen participated in the initial strategy planning workshop in June 1994. An Inter-Centre Working Group on Information, to be designated by the Centre Directors Committee on Information, will coordinate systemwide information activities on behalf of the centres. Standing working subgroups and ad hoc task forces would be organized to carry out specific projects. A task force, led by CIAT, was established to conduct the necessary technical, legal and financial requisites of the proposed Integrated Voice and Data Network. By the end of 1994, plans for the implementation of the IVDN over an 18-month period were available and it was anticipated that by the end of 1994, a total of 12 Centres, plus the two Secretariats, would be interconnected.

ECOREGIONAL INITIATIVES

LAC Ecoregional Convenor Initiative

CIAT has the role of ecoregional convenor in the CGIAR system to improve the management of agricultural resources in tropical America. In 1994 CIAT consulted with CG and regional partners to prepare an initial project. It proposes to build on CIAT's existing core competence in geographic information systems and analysis and to put this competence and the service of other centres working in the region: CIMMYT, CIP, ICRAF. It also proposed to develop a system of electronic data exchange among IARCs for georeferenced continental climate, soils and agricultural data. It further proposed to provide expertise in spatial modelling and data bases to strengthen existing agroecosystem consortia in the region. It envisaged the following resources for 1996-98:

- US\$ 367,000 For GIS studies for CIMMYT, CIP, ICRAF and ICRISAT.
- US\$ 871,000 For GIS modelling work to support the agroecosystem networks
- US\$ 1,184,000 For research in existing agroecosystem networks
- US\$ 718,000 For project coordination at CIAT

Alternatives to Slash-and-Burn (A global initiative)

The Alternatives to Slash-and-Burn initiative (ASB) was established in 1992, with the goal of reducing deforestation caused by slash-and-burn agriculture, by providing technology alternatives and policy options that reduce the need to clear additional land and encourage the reclamation of degraded lands. It is clearly congruent with the forest margins priorities as laid out in the 1991 CIAT Strategic Plan.

The following institutions are members of ASB as of December 1994: Agency for Agricultural Research and Development (AARD), Indonesia; CIFOR; CIAT; Department of Environment and Natural Resources (DENR), Philippines; EMBRAPA, Brazil; FUNDEAGRO, Perú; INIA, Perú; INIFAP, Mexico; Institut de Recherches Agronomiques, Cameroon; ICRAF; IFDC, USA; IFPRI; IITA; IRRI; Ministry of Agriculture and Cooperatives, Thailand; Ministry of Agriculture, Food and Fisheries, Zambia; TSBF and WRI. ICRAF acts as Global Coordinator and CIAT's role in ASB is to act as LAC regional coordinator, and contribute to biophysical and socioeconomic research conducted by the consortium.

African Highlands Initiative

ICRAF is the Coordinator of the African Highland Initiative launched in 1993 in response to a TAC recommendation to launch an ecoregional programme in the African Highlands. The AHI will initially focus on two main research themes: (1) maintenance and improvement of soil productivity, and (2) management strategies for plant protection in intensive systems. Another important theme, management of genetic resources, is also of high priority. Partners in the AHI are NARS (Burundi, Eritrea, Ethiopia, Kenya, Madagascar, Rwanda, Tanzania, Uganda, Zaire), CGIAR Centres (CIAT, CIMMYT, CIP, ICRAF, ICRISAT, IITA, ILCA, IFPRI, IPGRI, ISNAR), other international programmes (CTA, TSBF), a network of NGO's called the African Research Utilization Network (ARUNET), and the governing body of legal authority for the initiative, the Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA). The budget for Phase I is US\$ 2.11 million.

CIAT-SPONSORED NETWORKS

Bean Programme:

Network title:	Eastern Africa Regional Bean Network
Acronym:	EABRN
Countries involved:	Uganda, Kenya, Ethiopia, Somalia, Madagascar, Sudan
Date started:	1984
Activity:	Improve nutritional status and income of the poor in the region through promotion of bean research.

CIAT's role:	Member of steering committee Technical assistance Manages finances
Funding source:	CIDA, USAID 1995
Network title:	Réseau pour l'Amélioration du haricot (Phaseolae) dans la région de l'Afrique Centrale
Acronym:	RESAPAC
Countries involved:	Rwanda, Burundi, Zaire (Great Lakes Region)
Date started:	1983
Activity:	Strengthen national research capacity and intraregional cooperation for the development of improved bean production technology, thereby leading to increased production of beans in the region.
CIAT's role:	Technical assistance Member of steering committee Manages finances
Funding source:	SDC (1995)
Network title:	Southern Africa (SADC) Bean Network
Acronym:	SABN
Countries involved:	Southern Africa (Angola, Botswana, Lesotho, Malawi, Mozambique, Swaziland, Tanzania, Zambia and Zimbabwe)
Date started:	1985
Activity:	Increase bean productivity and production and to strengthen National Bean Research in the Countries of the Southern African Development Coordination Conference (SADCC) under the Coordination of the Southern Africa Coordinating Centre for Agricultural Research (SACCAR)
CIAT's role:	Technical assistance Member of steering committee
Funding source:	SACCAR (funded by member countries)
Network title:	Proyecto Regional de Frijol para la Zona Andina
Acronym:	PROFRIZA
Countries involved:	Ecuador, Perú, Bolivia, Colombia y Venezuela
Date started:	1988
Activity:	Increase the productivity, production and consumption of bean in the Andean Region, through the strengthening of research capacity and transfer of technology in national institutions and promotion of interregional cooperation.
CIAT's role:	Regional coordination
Funding source:	Swiss Development Cooperation (SDC) to 1996

Network Title: **Phaseolus beans advanced biotechnology research network**
 Acronym: **BARN**
 Countries involved: Colombia, Mexico, Brazil, Italy, USA, U.K., Germany
 Date started: 1990
 Activity: Promote, coordinate phaseolus beans biotechnology research training of LDCs
 CIAT's role: Coordination
 Funding: GTZ/BMZ (likely) 1995-98

Cassava Programme

Network title: **Asian Cassava Network**
 Acronym:
 Countries involved: Principal Asian cassava producing countries
 Date started: 1987
 Activity: Breeding and agronomy Research, information exchange.
 CIAT's role: Secretary of the Advisory Committee, technical support in breeding, agronomy and economics.
 Funding source: Core for CIAT participation; UNDP and Japan in the past

Network title: **Panamerican Cassava Breeders Network**
 Acronym:
 Countries involved: Latin America
 Date started: 1987
 Activity: Breeding research
 Information exchange (Triannual Meeting)
 CIAT's role: Convener, Scientific and technological support
 Funding source: Core and participating countries resources

Network title: **Manihot Genetic Resources Network**
 Acronym: **MGRN**
 Countries involved: 16 countries from Africa, Asia, and Latin America, plus IPGRI, IITA, CIAT.
 Date Started: Aug. 1992
 Activity: Conservation, documentation, and utilization of genetic resources of Manihot
 CIAT's role: Secretariat and member of the steering committee
 Funding source: IPGRI, CIAT, IITA for first initial meeting.

Network title: **Southern Cone Cassava Development Network**
 Acronym:
 Countries involved: Paraguay, Argentina, Brazil.

Date started: 1992
 Activity: Collaborative activities in the areas of:
 Germplasm development
 Crop management
 Post-harvest research
 Socio-economic studies
 Technology transfer
 CIAT's role: Member of the Executive Committee, technical support in the above areas
 Funding source: Core and special project funding from various sources (IDB, IFAD,...)

Network title: **Cassava Biotechnology Network**
 Acronym: CBN
 Countries involved: Global
 Date started: July 1992
 Activity: Definition of Biotechnology Research Priorities, Stimulation of Biotechnology Research on Cassava information Exchange. (Newsletter, Scientific meetings etc.)
 CIAT's role: Provides logistical and technical support for the Network Coordinator.
 Funding source: DGIS (Holland) 5 years.

Rice Program

Network title: **International Network for Genetic Evaluation of Rice, Latin America and the Caribbean**
 Acronym: INGER-LAC (former IRTIP from 1976 to 1985)
 Countries involved: Latin America and the Caribbean; IRRI
 Date started: 1976
 Activity: Rice Germplasm related activities
 CIAT's role: Regional liaison for global network
 Funding source: UNDP until 1991; CIAT and IRRI from 1991

Network title: **Caribbean Rice Improvement Network**
 Acronym: CRIN
 Countries involved: Caribbean countries
 Date started: 1987
 Activity: Rice Germplasm related activities
 CIAT's role: Lead partner and executing agency
 Funding source: Canadian International Devel. Agency, CIDA, until, 1992; none current

Tropical Forages Programme

Network title: **Red Internacional de Evaluacion de Pastos Tropicales**
 Acronym: **RIEPT**
 Countries involved: **RIEPT-MCAC**(Mexico, Central America and Caribbean Countries).
RIEPT-Tropical Lowlands (Brazil, Bolivia, Colombia, Ecuador, Peru, Venezuela) northern parts of Argentina and Paraguay)
 Date started: 1979, split into regional areas in 1987.
 Activity: Present activity
 i) Germplasm exchange
 ii) Collaborative research
 iii) Communication
 iv) Training
 CIAT's role: Facilitator for activities. In MCAC, countries to form national networks to discuss priorities.
 Funding source: RIEPT received Special Project funding until 1992. Present funding is from core funds.

Network title: **South East Asia Forage Research and Development Network**
 Acronym: **SEAFRAD**
 Countries involved: China, Indonesia, Lao PDR, Malaysia, Philippines, Thailand, Vietnam.
 Date started: Initiated in 1989. Activity commenced in four countries in 1992 with special Project Funding from AIDAB and now extended to 7 countries.
 Activity: Germplasm exchange, on-farm research, seed production, communication, training.
 CIAT's role: CIAT facilitates program implementation. Communication through national coordinators.
 Funding source: AIDAB

CIAT NETWORK MEMBERSHIP

Bean Programme

Network Title: **Programa Cooperativo Regional de Frijol de Centroamerica, Mexico Y el Caribe.**
 Acronym: **PROFRIJOL**
 Countries involved: Central America, The Caribbean and Mexico (Costa Rica, Cuba, Rep. Dominicana, El Salvador, Guatemala, Haiti, Honduras, Mexico, Nicaragua, Panama, Puerto Rico)

Date started: 1978
 Activity: Increase the productivity, production and consumption of bean in the Andean Region, through the strengthening of research capacity and transfer of technology in national institutions and promotion of interregional cooperation.
 CIAT's role: Technical assistance
 Manages finances
 PROFRIJOL was devolved from CIAT to the region in 1993
 Funding source: SDC, 1996

Cassava Programme

Network title: **Programa de desarrollo de la agroindustria rural**
 Acronym: **PRODAR**
 Countries involved: Latin America
 Date started: 1990
 Activity: Promotion and information exchange on rural agronomy.
 CIAT's role: Member
 Funding source: IICA, French cooperation, IDRC, CIRAD.

Rice Programme

Network title: **The International Program on Rice Biotechnology - Rockefeller Foundation**
 Acronym:
 Countries involved: CG Centres, Universities, Research Institutes from Developed and Developing Countries. Global Network.
 Date started: 1980. Ciat's involvement: 1986.
 Activity: Rice Biotechnology and applications for germplasm development.
 CIAT's role: Active member
 Funding source: Rockefeller Foundation. Indefinite term.

Network title: **Comissao Tecnica de Arroz**
 Acronym: **CTARROZ**
 Countries involved: Brazil, Colombia
 Date started: 1982. Ciat's involvement: 1989.
 Activity: Rice Germplasm evaluation activities
 CIAT's role: Provides germplasm
 Funding source: EMBRAPA and State Institutions in Brazil. Indefinite Term.

Network title: **Conference des Responsables de Recherche Agronomique Africains.**
Acronym: CORAF
Countries involved: West Africa and Madagascar
Date started: 1992
Activity: Rice Germplasm related activities
CIAT's role: Germplasm exchange
Funding source: CIRAD-CA, Minister de la Cooperation Francaise. Indefinite Term.

Land Management SRG

Network title: **UNEP Collaborating Centres for International Environmental Assessment, Reporting and Forecasting**
Acronym:
Countries involved: Institutes in The Netherlands, USA, Colombia (CIAT).
Date started: CIAT's involvement started at 6 December, 1994
Activity: Cooperation in environmental and sustainable development activities.
CIAT's role: CIAT is one of the Collaborating Centres. CIAT is hosting an International Workshop on the Global Environmental Outlook Project. A proposal to create a Data Centre on Sustainability Indicators for Latin America and the Caribbean at CIAT is being considered by UNEP.
Funding source: Network activities are financed by UNEP

Network title: **Strategies for Sustainable Agricultural Land Use in the Lowland Savannas of South America**
Acronym: SALLSSA
Countries involved: Bolivia, Brazil, Colombia, Venezuela and The Netherlands
Date started: May 1994
Activity: Preparing position papers and defining a joint project proposal
CIAT's role: Coordination
Funding source: DGIS (The Netherlands). Network was financed for planning stage; new activities pending approval of the project.

Biometry Unit

Network title:	International Biometric Network for Central America, the Caribbean, Colombia and Venezuela
Acronym:	
Countries involved:	Mexico, all Central American and Caribbean countries, Colombia, Venezuela.
Date started:	1991
Activity:	Applied Biometrical/Statistical/Mathematical methods and tools for the benefit of agriculture and environmental research; invited members from Europe, Canada, USA.
CIAT's role:	CIAT is a member of the scientific/organizing Committee; planning, organization and financing of the 4th Annual Meeting Conference in June 95.
Funding source:	1st meeting financed by the Fund Biometric Society USA. No continuing funding.

GLOSSARY OF ACRONYMS

AARD	Agency for Agricultural Research and Development, Indonesia
AC	Anther Culture
ACMV	African Cassava Mosaic Geminivirus
ADG	Assistant Director General
AFLP	Amplified Fragment Length Polymorphism
AFNET	African Forage Network
AHI	African Highlands Initiative
AIDAB	Australian International Development Assistance Bureau (Australia)
ARUNET	African Research Utilization Network
ASARECA	Agreement on Strengthening Agricultural Research in Eastern and Central Africa
ASB	Alternatives to Slash-and-Burn Initiative
ATFGRC	Australian Tropical Forages Genetic Resources Centre
BARN	Phaseolus Beans Advanced Biotechnology Research Network
BGMV	Bean Golden Mosaic Virus
BMZ	Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung
BRU	Biotechnology Research Unit
CAMBIA	Centre for the Application of Molecular Biology in Agriculture
CATIE	Centro Agronómico Tropical de Investigación y Enseñanza (para América Central)
CARDI	Caribbean Agricultural Research and Development Institute
CBN	Cassava Biotechnology Network
CCMV	Cassava Common Mosaic Virus
CENARGEN	Centro Nacional de Recursos Genéticos
CGIAR	Consultative Group on International Agricultural Research
CIAT	Centro Internacional de Agricultura Tropical
CIFOR	Centre for International Forest Research
CIDA	Centro de Información y Documentación Agropecuaria (Cuba)
CIP	Centro Internacional de la Papa
CIPASLA	Consorcio Interinstitucional para una Agricultura Sostenible en Laderas
CIRAD	Centre de Coopération Internationale en Recherche Agronomique pour le Développement (Montpellier, France)
CIRAD-CA	Centre de Coopération Internationale en Recherche Agronomique pour le Développement - Département des Cultures Annuelles
CIRAD-SAR	Centre de Coopération Internationale en Recherche Agronomique pour le Développement - Département de Systèmes Agro-alimentaires et Ruraux
CIMMYT	Centro Internacional de Mejoramiento de Maíz y Trigo
CONDESAN	Andean Ecoregion Consortium
CORAF	Conférence des Responsables de Recherche Agronomique Africains
CORPOICA	Corporación Colombiana de Investigación Agropecuaria

CPAC	Centro de Pesquisa Agropecuária dos Cerrados
CRIN	Caribbean Rice Improvement Network
CSIRO	Commonwealth Scientific and Industrial Research Organization
CTA	Technical Centre for Agriculture and Rural Cooperation
CTARROZ	Comissao Tecnica de Arroz
CVMV	Cassava Vein Mosaic Virus
DENR	Department of Environment and Natural Resources, Philippines
DG	Director General
DGIS	Netherlands Agency for International Cooperation
DDG	Deputy Director General
DDGR	Deputy Director General Research
DNA	deoxyribonucleic acid
EABRN	Eastern Africa Regional Bean Network
EMBRAPA	Empresa Brasileira de Pesquisa Agropecuária
EMR	External Management Review
EO	Executive Officer
FAO	Food and Agriculture Organization of the United Nations
FEDEARROZ	Federation of Rice Growers
FLAR	Fondo Latinoamericano para el Arroz de Riego
FONAIAP	Fondo Nacional de Asistencia e Investigación Agropecuaria
FSV	Frog Skin Virus
GIS	Geographic Information Systems
GRU	Genetic Resources Unit
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit (Germany)
HRD	Human Resources Department
IARC	International Agricultural Research Centre
IBSRAM	International Board for Soil Research and Management
IBTA	Instituto Boliviano de Tecnología Agropecuaria
ICARDA	International Centre for Agricultural Research in Dry Areas
ICID	International Commission on Irrigation and Drainage
ICLARM	International Centre for Living Aquatic Resources Management
ICM	Integrated Crop Management
ICPM	Integrated Crop and Pest Management of cassava
ICRAF	International Centre for Research in Agroforestry
ICSM	Integrated Crop and Soil Management
ICRDP	Integrated Cassava Research and Development Projects
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
ICWG-GR	Inter-Centre Working Group on Genetic Resources
ICW	Inter-Centres Week
IDB	Inter-American Development Bank
IDRC	International Development Research Centre, Canada
IFAD	International Fund for Agricultural Development (Rome, Italy)
IFDC	International Fertilizer Development Center, Mussel Shoals (Alabama, USA)

IFPRI	International Food Policy Research Institute
IICA	Instituto Interamericano de Cooperación para la Agricultura
IIMI	International Irrigation Management Institute
IITA	International Institute of Tropical Agriculture
ILRAD	International Laboratory for Research of Animal Diseases
ILRI	International Livestock Research Institute
INGER-LAC	International Network for Genetic Evaluation of Rice, Latin America and the Caribbean
IPGRI	International Plant Genetic Resources Institute
IPM	Integrated Pest Management
IRTP	International Rice Testing Program (Phillipines - CIAT)
IRRI	International Rice Research Institute
ISNAR	International Service for National Agricultural Research
ISAR	Institut des Sciences Agronomiques du Rwanda
IUCN	International Union for Conservation of Nature and Natural Resources, Switzerland
IWRA	International Water Resources Association
JIRCAS	Japan International Research Centre for Agricultural Science
LAC	Latin American and the Caribbean
MCAC	Mexico Central America and Caribbean Countries
MAS	Management of Acid Soils
MGR-DNA	Magnaporta grisea repeat-Deoxyribonucleic Acid
MGRN	Manihot Genetic Resources Network
MT	Metric Ton
MTP	Medium Term Plan
NARDS	National Agricultural Research and Development Systems
NARS	National Agricultural Research Systems
NGO	Non-Governmental Organization
NRI	National Resources Institute, U.K.
NRM	Natural Resources Management
OAS	Organization of American States
ODA	Overseas Development Administration, U.K.
ORSTOM	Institut Français de Recherche Scientifique et Technique d'Outre-Mer
PROCIANDINO	Programa Cooperativo de Investigación Agrícola para la Subregión Andina
PROCI	Programa Cooperativo en Investigación
PROCISUR	Programa Cooperativo de Investigación Agrícola del Cono Sur
PROCITROPICOS	Programa Cooperativo de Investigación y Transferencia de Tecnología para los Trópicos Suramericanos
PRODAR	Programa de Desarrollo de la Agroindustria Rural
PROFRIJOL	Programa Cooperativo Regional de Frijol de Centroamérica, Mexico y el Caribe
PROFRIZA	Proyecto Regional de Frijol para la Zona Andina
PSSM	Production Systems and Soils Management

QTL	quantitative trait loci
RAPD	Randomly amplified polymorphic DNA
R&D	research and development
RESAPAC	Réseau pour l'Amélioration du haricot (Phaseolae) dans la région de l'Afrique Centrale
RESEAPAC	Great Lakes Regional Network
RFLP	restriction fragment length polymorphism
RIEPT	Red Internacional de Evaluación de Pastos Tropicales
RHBV	rice hoja blanca virus
RNA	ribonucleic acid
RMR	Resource Management Research
RP	Rice Programme
SACCAR	Southern African Centre for Cooperation in Agricultural Research (Gaborone, Botswana)
SABN	Southern Africa (SADC) Bean Network
SCARS RAPD	Sequence characterized amplified regions - Randomly amplified polymorphic DNA
SALLSSA	Strategies for Sustainable Agricultural Land Use in the Lowland Savannas of South America
SEAFRAD	South-East Asia Forage Research and Development Network
SDC	Swiss Development Cooperation
SGRP	Systemwide Genetic Resources Programme
SRF	Senior Research Fellow
SRG	Scientific Resource Group
SSR	Simple Sequence Repeat
SWNM	Soil, Water and Nutrient Management
TAC	Technical Advisory Committee
TPF	Tropical Forage Programme
TSBF	Tropical Soil Biology and Fertility Programme (Kenya)
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
USAID	U.S. Agency for International Development
VRU	Virology Research Unit
WARDA	West Africa Rice Development Association
WB	World Bank
WMO	World Meteorological Organization
WRI	World Resources Institute (USA)