

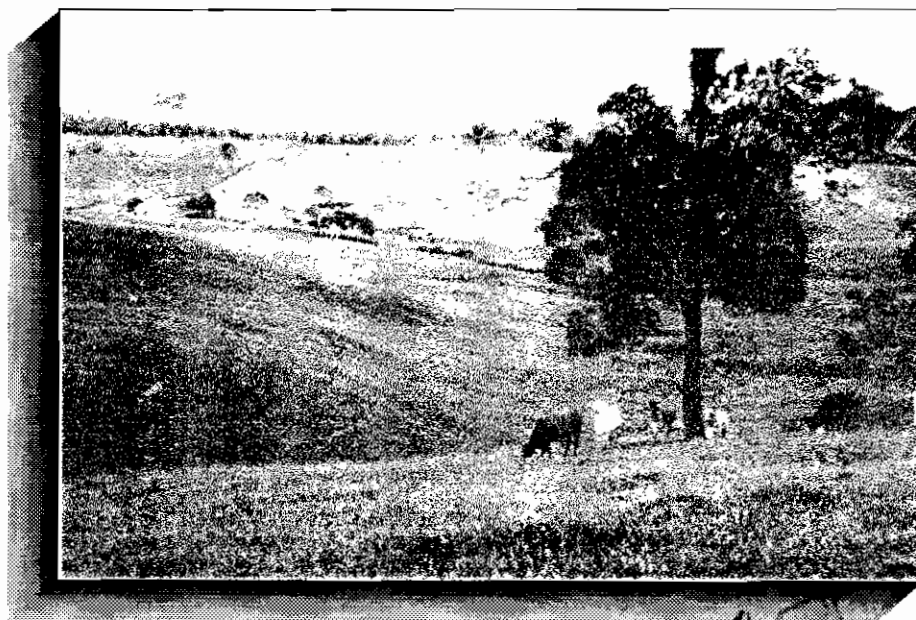
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CIAT

COLECCION HISTORICA

**Pilot Development Program
of Dual-Purpose
Production Systems
in the Amazon Foothills
of Caquetá, Colombia**



A proposal for:

Der Bundesminister für Wirtschaftliche
Zusammenarbeit (BMZ)

Special Project Funding

Submitted by:

CIAT

Centro Internacional de Agricultura Tropical

August 1992

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Cover Photo:
Dual Purpose Cattle Grazing Pastures in
The Foothills of Caquetá, Colombia



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Acronyms

BMZ	Federal Ministry for Economic Cooperation
CIAT	Centro Internacional de Agricultura Tropical
FGV	Fondo Ganadero del Valle
ICA	Instituto Colombiano Agropecuario
MASL	Metres Above Sea Level
TUB	Technical University of Berlin

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1. Summary

Title: Pilot Development Program of Dual-Purpose Production Systems in the Amazon Foothills of Caquetá, Colombia.

Objective: To contribute to farmers' and consumers' welfare by increasing milk and beef production in dual-purpose cattle production systems in a humid forest ecosystem while conserving the environment.

Abstract: The Andean piedmont of the Amazon basin in the Caquetá Department of Colombia is an integral part of the American tropical rainforest. Over the last 40 years, the area around the capital city of Florencia has been subject to an intensive process of colonization. As a consequence, there are 0.7 million hectares totally deforested and covered by unproductive naturalized grasses dedicated to dual cattle production (simultaneous production of beef and milk).

Grasses and legumes species selected for acid infertile soils by CIAT's Tropical Forages Program have been successfully introduced in degraded areas of the region. This has been documented in a joint project of the Instituto Colombiano Agropecuario (ICA), CIAT and the Technical University of Berlin (TUB) financed partially by BMZ.

To follow-up this initial effort, there is a need to determine the contribution of the new pastures to animal production and to soil improvement. In order to increase technological components, new forage germplasm including multi-purpose shrubs and crops need to be screened for adaptation to abiotic and biotic factors. To transfer results to farmers there will be an increasing need for seed supply and for technical assistance through inter-institutional cooperation in the region.

Cooperating Partners: The cooperating partners includes:

Centro Internacional de Agricultura Tropical, (CIAT).

Colombian institutions like Instituto Colombiano Agropecuario (ICA), Universidad de la Amazonía, Fondo Ganadero del Valle.

German institutions: University of Hohenheim and Technical University of Berlin.

Names of Principal Scientists:

The CIAT Project Manager will be Dr. Peter Kerridge, Leader of the Tropical Forages Program, who will be assisted by Dr. Jan Salick, Leader of the Forest Margins Program. The principal CIAT research scientists involved in this project include:

Dr. I.M. Rao, Plant Nutrition, Tropical Forages Program
Dr. C. Lascano, Animal Nutrition, Tropical Forages Program
Dr. R. Thomas, Nitrogen Cycling, Savannas Program

The principal scientists of the Colombian collaborating institutions include:

Dr. Miguel Vanegas, Instituto Colombiano Agropecuario
Prof. Gustavo Soto, Universidad de la Amazonfa
Dr. José F. Suzo, Fondo Ganadero del Valle

The principal scientists of the German collaborating institutions include:

Prof. Dr. Rainer Schultze-Kraft, University of Hohenheim
Prof. Dr. K.J. Peters, Technical University of Berlin

Budget: (In thousands of current US dollars)

BMZ contributions	Year 1	Year 2	Year 3	Total
to CIAT	110.0	85.4	92.4	287.8
to U of Hohenheim	60.0	55.0	55.0	170.0
to T. U. of Berlin	76.0	55.0	51.0	182.0
Total	246.0	195.4	198.4	639.8

2.0 Background and Justification

Special project funding from BMZ is being requested in order to enable CIAT, in cooperation with German Universities and Colombian national institutions, to coordinate a research and development program leading to the reclamation of degraded pastures in the Amazon foothills of Colombia.

2.1 The Target Area

The Andean piedmont of the Amazon basin in the Caquetá Department of Colombia is an integral part of the American tropical rainforest. The Caquetá Department is located between 0° and 2° N latitude and 71° and 76° W longitude. It covers 8.9 million hectares, including 6.6 million hectares of rainforest and 1.8 million hectares of Andean piedmont. It is estimated that 1.4 million hectares of the latter region is below 1000 masl and dedicated to cattle production. Similarly, 90% of the human population is found in the piedmont. The piedmont soils (Ultisol) are acid and of low-natural fertility.

2.2 Colonization and Deforestation

Over the last 40 years, the piedmont area around the capital city of Florencia has been subjected to an intensive process of colonization, driven mostly by socio-political and economic reasons. The opening of a new major highway ("marginal de la selva") may induce a further increase in the process of colonization, with the well known environmental implications.

CIAT's and other studies have shown that as a consequence of the process of colonization, there are 0.7 million hectares totally deforested, which are covered by low productivity native grasses (Ramírez and Seré, 1990) and with little chance for the re-establishment of a secondary forest.

2.3 Use of Deforested Areas

After a process of trial-and-error, production systems in these mostly hilly lands are presently dominated by dual-purpose cattle operations. This type of semi-intensive system is favored by an extensive network of roads, tracks and rivers and a reliable marketing structure for milk (Michelsen, 1990). In 1986, Caquetá produced 57 million

Colonization in the Piedmont area has resulted in deforestation

Dual-purpose cattle operations dominate this area

liters of milk, or about 2% of the total production in Colombia. During the same decade, milk production grew at an annual rate of 7.5%, which exceeds the rate of 5.1% for Colombia as a whole (Michelsen, 1990). Beef production systems are also common, especially in more remote parts of the region. Crops such as rice are mostly confined to the better soils of the river banks.

2.4 Pasture Degradation and Alternatives for Reclamation

Beef and milk are produced exclusively on directly grazed pastures, mostly degraded and covered by native grasses (i.e., *Homolepsis aturensis*) of low nutritive value and carrying capacity. As a consequence, milk production is low in the order of 3-4 liters/cow/day and 600-700 liters/hectares/year (Ulrich C., Thesis in preparation).

An increasing number of settlers are aware of the environmental degradation that has taken place in the area. Similarly, a number of national institutions are present in the region trying to address some of the problems of pasture degradation and soil erosion. However, technological alternatives that are economically attractive appear to be limited.

Over the period 1987-90, CIAT's Tropical Pastures Program (now known as the Tropical Forages Program) collaborated with several institutions present in the region in the on-station and on-farm evaluation of forage germplasm adapted to acid soils with a potential for reclaiming degraded pastures. A number of studies have also examined techniques for the establishment of grass-legume pastures using minimum tillage. This effort has resulted in the identification of grasses and legumes and on the establishment in a number of farms of legume-based pastures of high quality and productivity.

2.5 Needs on Research and Transfer of Technology

A completed joint project of ICA, CIAT and TUB financed partially by BMZ, documented the on-farm performance of the new grass-legume pastures. Results indicated that some

Milk production is low because of the low nutritive value of the native grasses

CIAT's research on forage germplasm adapted to acid soils can help reclaim degraded pastures

There is now a need to identify additional forage germplasm to test alternative production strategies

grass-legume combinations are highly productive and persistent under the farmers' management. However, as a follow-up of this initial effort, there is a need to determine the long-term contribution of the new pastures to animal production (i.e., milk, liveweight gain) and to soil improvement. In order to find new feed resources and to test alternative production strategies in existing dual cattle purpose production systems, there is a need to identify additional forage germplasm, including forage shrubs and acid soil tolerant crops.

A fundamental aspect of the project is that reclamation of degraded grazing areas through the introduction of already tested grasses and legumes is technically viable and economically attractive.

3.0 Project Objectives

3.1 Goal

The general goal of the program is to contribute to the increase of farmers' income and of milk and beef to consumers using appropriate technologies while conserving the environment. This should lead to reduced pressure on the remaining forested lands.

3.2 Project Purpose

The purpose or specific objective of this project is to intensify dual purpose production through reclamation of degraded pastures in the humid forest using appropriate forest and crop germplasm.

Thus, the project will define and quantify the role of legume-based pastures on dual purpose systems in already cleared forest lands and will identify and transfer to farmers sustainable land reclamation technologies based on new pasture and crop options.

3.3 Project Outputs

The project outputs describe what the project will accomplish and are the basic deliverables for which the CIAT project team and German counterparts will be held accountable and the reason for which the team is given resources. The major outputs from the project are as follows:

- Documentation of the role of legume-based pastures on animal production in dual purpose systems and on soil improvement on degraded lands.
- Identification of new forage and crop germplasm adapted to the ecosystem
- Extension and promotion of technology

3.4 Project Description

Traditional grass-based pasture systems are not very sustainable, particularly those on nutrient-poor acid soils. This is mainly due to the use of non-adapted forage germplasm, poor management, depletion of soil nutrient reserves and high levels of soil erosion. However, improved pastures based on adapted grasses and legumes that

The project has a clearly defined goal, purpose and outputs

One project output is documentation of the role of legume-based pastures on animal production and soil improvement

effectively fix nitrogen and recycle nutrients have the potential to contribute not only to long-term animal production but also to soil conservation and improvement (Lascano and Estrada, 1989; CIAT Annual Report 1991).

The project includes a study that will attempt to define and quantify in detail the contribution of legume-based pastures to milk production and liveweight gain and to soil improvement when compared to grass alone and native pastures in a humid forest ecosystem. This output will be useful for extension purposes and for the validation of a pasture nutrient cycling model being developed by CIAT for acid soils in the tropics. Intensive monitoring of pastures included in the prior BMZ-financed project plus those sown with and without crops in the present initiative will provide short and long-term data to document the role of various proposed interventions.

Only a few grasses were tested in the earlier BMZ financed study

Forage germplasm initially tested in the BMZ financed project was limited to a few grasses (i.e., *Brachiaria humidicola*, *Brachiaria dictyoneura*) and legume species (i.e., *Desmodium ovalifolium*, *Centrosema macrocarpum*). Thus, the project includes screening and evaluation of a large number of accessions of grasses, herbaceous and shrubby legumes. Crops such as upland rice lines developed for acid soils will also be tested in order to determine the feasibility of developing agropastoral systems.

This project promotes inter-institutional cooperation and provides for a steering committee

Research carried out in the region within the BMZ-financed project resulted in an increasing demand for seed and technical assistance even in the absence of formal extension and promotion activities. It also created a useful and extremely dynamic framework for informal inter-institutional cooperation in the region, with a workable division of labor among institutional partners. The project will promote extension activities through the creation of an inter-institutional steering committee, with CIAT assuming the overall technical coordination and serving as the Committee's secretariat. The membership of the steering committee will be as follows:

Colombian institutional partners participate in the steering committee

- CIAT - TFP Leader (Technical Coordination)
- ICA Livestock Production Leader
- ICA Pasture Production Leader
- ICA Transfer of Technology Regional Leader
- Universidad de la Amazonía, Head Animal Science Department
- Fondo Ganadero del Valle, General Administrator

3.5 Project Benefits to Developing Countries and NARS

Research carried out by the International Network of Tropical Forages Evaluation (RIEPT) has identified a number of highly promising grass and legume species that have wide adaptability across the humid tropics of South and Central America. Their short-term on-farm performance has been documented in the Amazon basin of Perú and Colombia and on the Atlantic Coast of Costa Rica. The previous dual purpose project financed by BMZ to the technical U. of Berlin and CIAT contributed to that objective.

It is important to document the long-term contribution of forage species

It is clearly of high interest to document the **long-term** contribution of these forage species, in view of the controversy surrounding pasture development and the cattle industry throughout the humid tropics. Despite differences between countries in farming systems, CIAT's studies have demonstrated that cattle, and in particular, dual purpose animals, are a vital subsystem across the continent.

Research on new crop cultivars can help rehabilitate highly degraded pastures

More recently, new crop cultivars have been bred for the acid soils of the humid tropics; one such rice line will be commercially released in Perú in 1993. This development offers the opportunity to rehabilitate highly degraded pastures, rather than the continued need to open up newly deforested areas. This possibility has not yet been tested on-farm, and if feasible, the approach would have ample repercussions throughout the humid tropics region.

PROJECT OBJECTIVES

This project will help fund the increased participation of national institutions in more focused research

In the specific case of Caquetá, National Institutions enthusiastically joined the previous BMZ-financed project, but were seriously constrained from a more active role by financial limitations. The present proposal would allow them to participate actively in the project with clearly delimited responsibilities. The end result will be to strengthen the research focus of some of them, particularly that of the University de Amazonia, while the on-farm work will provide close ties to the farming community, thus benefiting both professors and students in terms of their client orientation.

4. Work Plan

The duration of the first phase is three years

The project considers an initial stage of three years, which, assuming it is successful, should lead to a second final stage conditional upon the favorable evaluation carried out with donor participation. The present proposal addresses the needs of the first stage only.

4.1 Project Activities

The principal activities of the project are graphically shown in Figure 1 and include:

Research

- Contribution of legume based-pastures to animal production and to soil conservation and enhancement
- Germplasm screening and evaluation
- Pasture establishment techniques
- Crop-pasture integration
- Monitoring of old and new pastures in representative farms to assess potential regional impact

Promotion

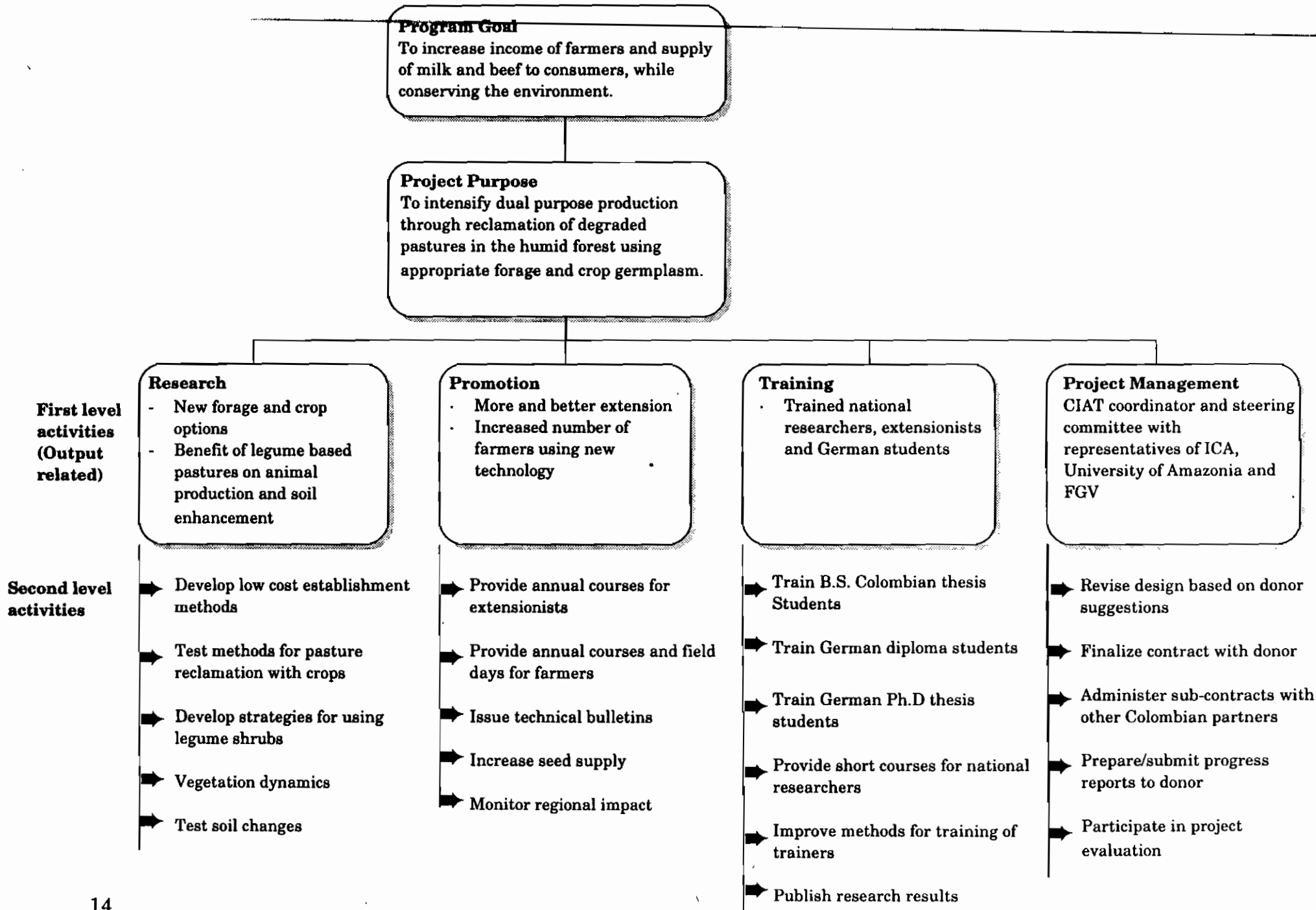
- Seed multiplication of "key" grasses and legumes, to be contracted out in other regions
- Annual training courses
- Direct technical assistance to representative farmers

The project has both research and promotion activities

The technical U. of Berlin will do strategic research in the contribution of legume-based pastures to animal production

Strategic research will be carried out by German counterparts in collaboration with CIAT scientists. The Technical University of Berlin will study the contribution to animal production of legume-based pastures and legume shrubs as protein banks or in cut and carry systems. Detailed measurements will be carried out in existing and

Figure 11
Work Break Down Structure of Project Activities



The University of Hohenheim will focus research on soil fertility

new grass alone and grass-legume pastures (i.e., associations and pure legume stands) on vegetation dynamics, quantity and quality of forage on offer and composition and quality of forage ingested by grazing animals. Pasture attributes will be used to explain animal production data.

The University of Hohenheim will participate in documenting the role of legume-pastures on soil fertility by quantifying a number of soil chemical, physical and biological parameters as well as below and above ground plant characteristics. In addition, it will participate in the screening and evaluation of new forage germplasm for reclaiming degraded pastures.

The project will enable the Universidad de la Amazonía and ICA to carry out additional research activities centered around new forage and crop germplasm. Specific research areas are:

National institutions will study new forage and crop germplasm

- Legume shrub and tree establishment techniques
- Minimum tillage systems for pasture establishment
- Rice/pasture and rice/legume shrubs intercropping in degraded lands
- Monitoring and documentation of on-farm and regional impact will be carried out by CIAT's Tropical Forages and Forest Margins Programs in collaboration with ICA and the Universidad de la Amazonía

Promotion activities will be carried out by ICA through its regional extension unit (CRECED). The project will enable CRECED to carry out the following activities:

- Annual courses on pasture establishment, pasture management and agropastoral systems for professionals working in extension, both from the private and public sectors

- Annual practical course and field days for farmers on pasture and crop establishment and management
- Direct technical assistance to representative farmers
- Provision of seed to farmers at cost, with the following target:
 - second year : 30 farms · third year : 60 farms
- Indirect technical assistance through in-office consultation, distribution of brochures and technical bulletins, etc. and provision of seed on a first-come first-served basis.

The project will be supported by on going promotional activities jointly carried out by the FGV and ICA, which include:

- Provision at cost of improved crossbred bulls and heifers
- Animal health advice
- Courses to technicians on artificial insemination

4.2 Implementation Schedule

The implementation schedule with the estimated duration of the major project activities is shown in Figure 2.

4.3 Project Management

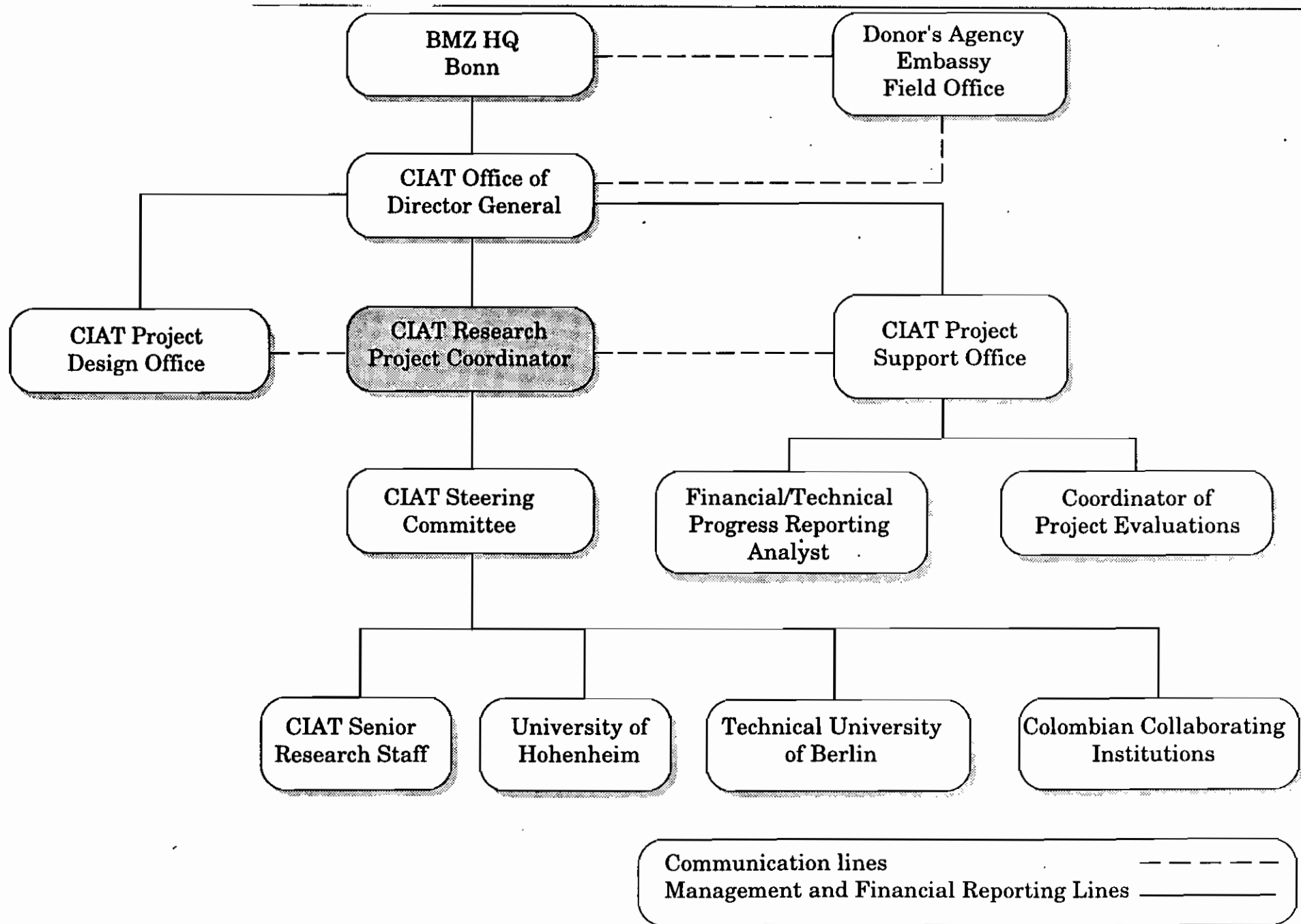
The organizational chart for the management of the project is shown in Figure 3.

*The project has a
Project Coordinator
and a Steering
Committee*

Figure 2. Chronogram of project activities by Quarters

Activity/Description	Year 1				Year 2				Year 3			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Interinstitutional Organization	■											
Meetings of steering committee				■	■	■	■	■	■	■		
RESEARCH												
Germplasm screening	■	■	■	■	■	■	■	■	■	■	■	■
Legumes/animal production	■	■	■	■	■	■	■	■	■	■	■	■
Legumes/soil improvement	■	■	■	■	■	■	■	■	■	■	■	■
Establishment	■	■	■	■	■	■	■	■	■	■	■	■
Crop/pasture integration	■	■	■	■	■	■	■	■	■	■	■	■
PROMOTION												
Training courses for extensionists						■	■			■	■	
Training courses for researchers					■				■			
Direct technical assistance					■	■	■	■	■	■	■	■
Assessment of impact									■	■	■	■
EVALUATION												
Prepare/submit annual progress report to donor				■				■				■
Participate in project evaluation									■			
Prepare end-of-project report												■

Figure 3. Project Organization Chart



5. Training

This project provides for training of national researchers

It also provides for training of national undergraduate thesis students as well as for German diploma and Ph.D. students

The project will place a significant emphasis on training. National counterparts will be trained in on-farm monitoring techniques, data analyses and interpretation. University graduates and technicians will participate in annual short term courses designed to provide theoretical and practical information on subjects related to the project. In addition, selected extensionists will participate in courses organized by CIAT to provide methods for "training of trainers".

National undergraduate students from the Universidad de la Amazonía will conduct their B.Sc. thesis research in the areas of pasture establishment, crop/pasture integration and other aspects related to the project. German students from the University of Hohenheim will conduct research for their diploma, mainly in the area of forage germplasm screening and evaluation. A Ph.D. student from the University of Hohenheim will conduct strategic research to study the effect of legume-based pastures on soil nutrient status. A Ph.D. student and Diploma students from the Technical University of Berlin will conduct research designed to quantify the benefits of legume-based pastures on animal production.

6. Expected Patentable Research Results

CIAT endorses the principle of free access to research results. It supports this through publication of research findings in international journals and in-house documents.

There are no patentable results anticipated in this project.

7. Budget (in thousands of current* US\$)

* assumes 5% annual inflation
on CIAT costs

ITEM	Year 1	Year 2	Year 3	Total
Contribution to CIAT				
Personnel	28	29	32	89
Supplies	10	12	7	29
Training	10	10	10	30
Travel & per diems	8	16	18	42
Publication of results			10	10
Equipment				
Vehicles	38			38
Microcomputers	5	5		10
Project administration (20%)	11	13.4	15.4	39.8
Sub-total	110	85.4	92.4	287.8
Contribution to U. of Hohenheim				
Personnel				
German Diploma students		4	4	8
German Ph.D. student	45	45	45	135
Travel & per diems	3	6	6	15
Equipment	12			12
Sub-total	60	55	55	170
Contribution to Technical University of Berlin				
Personnel				
German diploma students			4	4
German Ph.D. student	45	45	45	135
Travel and per diems	3	6	6	15
Equipment	28			28
Sub-total	76	55	51	182
GRAND TOTAL	246	195.4	198.4	639.8


 CIAT Financial Controller

CIAT

Budget Assumptions

CIAT Personnel Costs:

This budget item includes provision for one Research Associate (\$20,000 in Year 1), one Research Technician (\$6,000 in Year 1) and part-time labor (\$2,000 in Year 1).

Equipment

This budget item includes 2 four-wheel drive vehicles in Year One, two micro computers (one each in Years One and Two) plus miscellaneous field equipment.

German Personnel:

The provision of \$4,000 for each diploma student covers the costs for a three month period whereas the \$45,000 per year for a Ph.D. student covers all the expenses for spending 12 months a year on site.

8.0 Literature

Ramírez, A. y C. Seré (1990). *Brachiaria decumbens* en el Caquetá: Adopción y uso en ganaderías de doble propósito. Working Document N° 67. CIAT, Cali.

Michelsen, H. (1990). Análisis del desarrollo de la producción de leche en la zona tropical húmeda. El caso del Caquetá, Colombia. Working Document N° 60. CIAT, Cali