SUSTAINABLE ANIMAL PRODUCTION FOR THE AGROPASTORAL SYSTEMS OF THE BRAZILIAN CERRADOS

Special Project Funding

A Proposal for: BMZ

Executing Agency:

CIAT
International Center for Tropical Agriculture
Centro Internacional de Agricultura Tropical

Collaborating Partners:

- Göttingen University
- Deutscher Akademischer Austauschdienst
- EMBRAPA
- University of Uberlandia

January 1995

Centro Internacional de Agricultura Tropical CIAT

PDO-L003

January 5, 1995

Dr. J. de Haas
Head, Agriculture and Rural Development Division
Federal Ministry for Economic Cooperation and Development (BMZ)
Friedrich-Ebert-Allee 114-116
D-53113 Bonn
Federal Republic of Germany

Ref.: ***Proposals for Special Projects***

Dear Dr. Haas:

We are pleased to identify for your consideration three special projects involving cooperation between CIAT, German partners and NARS:

(1) ***Sustainable Animal Production for the Agropastoral Systems of the Brazilian Cerrados***

This proposal was submitted in August 1994 and the peer review committee considered it to be in principle worthwhile for funding. We have revised the proposal and have addressed the three issues raised in your previous letter. As per your instructions, we have forwarded copies of the revised proposal directly to ATSAF and GTZ.

(2) ***Dynamics and Sustainability of Farming and Regional Systems in the South American Savannas***

This proposal was submitted in August 1994, but arrived too late to be considered during the last Special Project Competition. We would appreciate if it would be now considered for the current competition. We understand from the BMZ fax of December 21, 1994 that there is no need to submit additional copies of the proposal at this stage since there have been no changes to the document submitted last August.

File: PDO 3.19.1

Mailing address, Apdo. aéreo 6713, CALI, COLOMBIA. Telex 05769 CIAT CO. ITT Dialcom ID 57:CGI301 FAX 57-23-647243. Tel. 57-23-675050

(3) ***Improving Efficiency in Calcium Acquisition and Utilization by Forage Grasses and Legumes***

Copies of this proposal have been forwarded directly to ATSAF and GTZ.

We look forward to continued support for our research cooperation with German universities and NARS and we would like to thank you for consideration of our new requests.

Yours sincerely,

ROBERT D. HAVENER
Interim Director General

Attachments

cc: Dr. E. Kurschner, ATSAF
Dr. J. Friedrichsen, Head of Division, Plant Production, Plant Protection and Agricultural Research, GTZ

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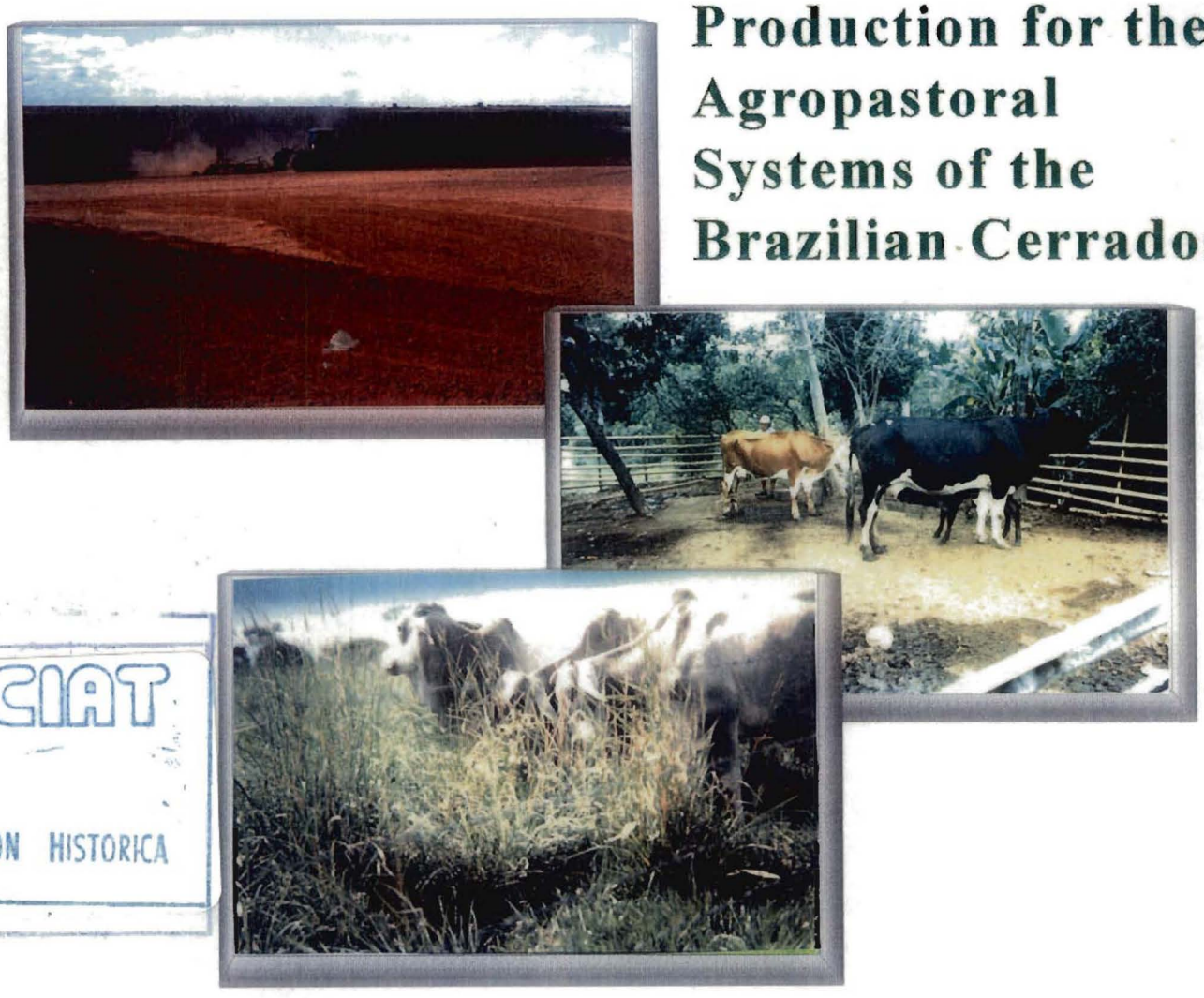

A Proposal for: Der Bundesminister für Wirtschaftliche Zusammenarbeit (BMZ)

Executing Agency:

CIAT
International Center for Tropical Agriculture
Centro Internacional de Agricultura Tropical

Collaborating Partners:

- Göttingen University
- Deutscher Akademischer Austauschdienst
- EMBRAPA
- University of Uberlandia

January 1995

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Acronyms

AFS	Australian Friesian Sahiwal
BMZ	Der Bundesminister für Wirtschaftliche Zusammenarbeit
CGIAR	Consultative Group on International Agricultural Research
CIAT	Centro Internacional de Agricultura Tropical, Cali, Colombia
CR	Conception Rate
DAAD	Deutscher Akademischer Austauschdienst
EMBRAPA	Empresa Brasileira de Pesquisa Agropecuária (Brazilian Agricultural Research Corporation)
F1	Cross of two pure breeds
Ha	Hectares
HF	Holstein-Friesian
ILRI	International Livestock Research Institute
LAC	Latin America and Caribbean
LIMS	Livestock Information Management System
LPEC	The Livestock Production Efficiency Calculator
NARS	National Agricultural Research Systems
THI	Temperature Humidity Index

1.0 Summary

Title: ***Sustainable Animal Production for the Agropastoral Systems of the Brazilian Cerrados***

Program Goal:

To develop alternative prototypes of production systems for the acid soil savannas which combine increased agricultural productivity with enhanced sustainability of the natural resource base.

Project Objectives:

(1) To assess the impact of pasture degradation and rehabilitation on biophysical and economic performance of Cerrados-based production systems.

(2) To reduce the beef industry's dependence on degraded, grass pastures;

(3) To optimise beef and dairy production from the new grass-legume technology at environmentally acceptable levels of agricultural inputs.

Outputs

The major outputs are:

(1) Cross-sectional analysis of current production systems;

(2) A causal model of pasture degradation and cattle production;

(3) Completed study on pasture management and beef cattle production;

(4) Completed study on cattle ecophysiology, health and husbandry;

(5) Completed final agricultural economic study on changes in the production systems.

Cooperating Partners:

- Göttingen University, Germany
- Deutscher Akademischer Austauschdienst, Germany
- EMBRAPA, Brazil
- University of Uberlandia, Brazil

Names of Principal Scientists:

- Dr. M.A. Ayarza, CIAT-EMBRAPA
- Prof. J.M. King, Göttingen University
- Dr. R.R. Vera, CIAT

Budget Total and Breakdown by Activities and Year (Current US$):

The total budget is US$762,240, broken down as follows:

Budget	*Year 1*	*Year 2*	*Year 3*	*Total*
CIAT	*76,950*	*76,050*	*79,950*	***232,950***
EMBRAPA	*19,605*	*25,425*	*26,160*	***71,190***
GÖTTINGEN UNIV.	*189,250*	*133,850*	*135,000*	***458,100***
Grand Total All Partners	***285,805***	***235,325***	***241,110***	***762,240***

2.0 Background and Justification

The case for halting the degradation of the pastures of the Brazilian Cerrados and encroachment of the rainforest margins has already been made by the international community, and adopted by CIAT with its new Tropical Lowlands Program. This project will be a component of the Program, and share its facilities and field sites at Uberlandia in the planalto of the Cerrados.

The animal production component is in harmony with the strategy[37] and programs[38, 39] of the new ILRI and with its global mandate for livestock research within the CGIAR. The role of CIAT in this strategy is to act as the LAC Ecoregional Centre[40] for various research organizations including ILRI[41].

Baseline productivity studies are needed before the loss from degradation and gain from pasture improvement can be quantified

2.1 Production Systems

In recent years, the main emphasis of CIAT's research on agropastoral production has been on the soil and plant components of the system. This research is now bearing fruit with the development of new grass-legume technology and its adoption by farmers. The improved forage production offers considerable scope for increased animal production, from both "indigenous" and exotic genotypes[9].

The extent of this improvement will not be quantifiable unless more work is done to establish the baseline of productivity of existing planted pastures, including the effect of various stages of degradation on cattle production.

The development of more intensive animal production systems, notably with exotic genotypes, carries with it economic and environmental costs and risks. These negative implications need to be considered and studied, so that problems can be anticipated or contained before they prejudice the adoption of the new grass-legume technology.

2.1.1 Beef from grass pasture

The starting point for the study is the planted *Brachiaria* grass pasture. During the last 25 years, approximately 40 million ha of pasture have been planted in the Brazilian Cerrados[1].

Alternative: "30 million ha. of Brachiaria pastures are in various stages of degradation"

The immediate effect of this planting was to increase beef cattle production from 20 to 200 kg/ha/year[2]. However, the grazing system proved to be unsustainable, and 85% of it is now estimated to be in advanced stages of degradation[1].

The loss, in terms of foregone animal production, is evident to the farmers of the Cerrados, but it has not been quantified either on research station or on farm. Little work has been done to characterize different stages of degradation, or to assess their potential for recovery[35].

Adding forage legumes help stabilize the grazing system on a fundable basis

2.1.2 Beef, dairy and new grass-legume technology

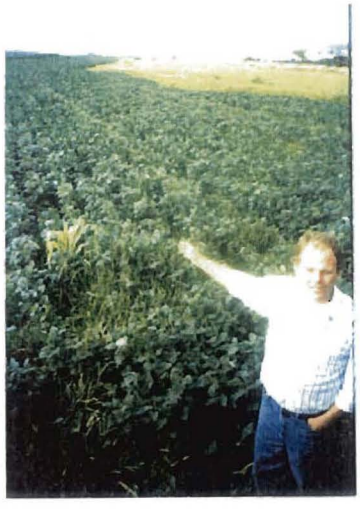
The addition of a legume to the grass pasture appears to stabilize the system. The combination is also more productive. For example, in the humid tropics, animal liveweight gains have increased from 150 kg/ha/yr on native grassland, to 350 kg/ha/yr on *Brachiaria* pasture, and 700 kg/ha/yr on improved grass-legume pasture[3].

Crop-pastures rotations are feasible alternatives

The main constraint to the adoption of this form of pasture rehabilitation, has been cost. However, it has been demonstrated in the Cerrados, that the pasture can be restored via a rice, bean or maize crop, which pays for the preparation and improvement of the soil[4]. The new pasture is not expected to last indefinitely, so periodic crop/pasture rotations will be required. This ley-farming approach is being adopted by some farmers in the proposed study area, around Uberlandia, and the system is expected to expand rapidly[36].

One constraint is replaced by others as cattle productivity increase

The new technology has reduced the main biophysical constraint on the existing cattle production systems, which was nutrition. It is encouraging the introduction of more intensive management and cattle with higher productive potential, notably from *Bos taurus* genes. This combination of factors will increase the importance of the two other major constraints to animal production in the tropics, namely disease and heat stress.



Improved pastures support better animal genotypes which are more susceptible to disease

Beef

Some producers plan to add *Bos taurus* genes to the existing Nellore zebu cattle production system in 1994. They wish to utilise the special characteristics of the F1, with the high growth potential of its *Bos taurus* parent and environmental resistance of its *Bos indicus* parent[5].

Such an approach has been proposed for the beef industry in tropical Australia, where it is suggested that the effects of high temperature, parasites, and some diseases, will be overcome primarily by use of better adapted and resistant cattle genotypes rather than by modifying the environment[6]. The process is complicated by the finding that, in reasonably adapted genotypes, selection for growth would result in improved heat tolerance but reduced resistance to parasites[7]. In the Brazilian context, some work has already been done on the resistance of the F1. Studies in the cerrado of Mato Grosso do Sul on purebred Nellore zebu cattle, their first crosses with European breeds and synthesis into the Ibage breed (5/8 *Bos taurus*), gave mean density counts of engorging female ticks per animal of 3, 23 and 60 respectively. With the exception of the purebred Nellore, mean counts at these levels are considered dangerous for the stability of enzootic "tick fever" (caused by Babesia and Anaplasma)[8].

Dairy

Milk production can be increased more with Crossbred Holstein-Friesian cattle

At least one farmer at Uberlandia has already increased the Holstein-Friesian (HF) component in his cattle to 15/16ths, because their lactation yield responded to improved forage production better than that of dual purpose cattle. His observation is supported by the finding that grass-legume pastures can increase milk production more in cows with medium than low genetic potential, the threshold being about 10 l/cow/day[9]. Selection to 15/16 HF may be too much, because a study in the same state of Minas Gerais of 1/2 through to 31/32 HF x zebu cows revealed that 1/2 to 3/4 HF crossbreeds had the best milk yield and lactation length[10].

Too much Bos taurus blood lead to unacceptable levels of clinical and subclinical disease

Bos taurus dairy cattle are as susceptible to tick infestation as their beef relatives, and have an additional disease problem related to their production system, namely: mastitis. For example, the frequency of subclinical mastitis in extensively managed dairy cattle in the humid tropical zone of Mexico was lowest in Sahiwals (20%), then zebu crosses, and highest in HFs (68%)[11]. A similar percentage was obtained for HFs in Java where the daily loss in milk yield from subclinical mastitis was estimated at 2 l/cow[12].

The biophysical environment is more important in dairy than beef cattle. In many parts of the tropics, it is physiologically impossible for ruminants to dispose of the heat produced by the feeding levels necessary for high yields of milk, without manipulation of the microclimate in which they live[13].

The climate at Uberlandia appears to be relatively benign by tropical standards, because it is located at an altitude of about 1000m. The mean annual temperature is 24°C and and the rainfall 1580mm[14]. Nevertheless, one would expect the ambient temperature to exceed 26.0°C during the hot months of the year, which is the upper critical air temperature at which milk production is depressed in Holstein-Friesians irrespective of milk yield or acclimatization[15]. Summer rainfall will reduce ambient temperature, but increase relative humidity so that the

Milk production and fertility of high yielding dairying cattle are depressed by heat and humidity.

These effects are mitigated by altitude at Uberlandia, but the level of heat-stress and ceiling to production need to be found

Massive importation of cattle germplasm from temperate regions into the L. American tropics has had disastrous consequences

Temperature Humidity Index (THI) will probably exceed 75. At this THI level, food intake and hence milk yield of Holstein cattle is reduced to compensate for their reduced ability to lose heat[16].

Even mild rises in cow body temperature, cause the cow to divert blood flow to its periphery from its core. As a result, reproductive performance is compromised; conception rate (CR) can be depressed 10-20%, calf birth weight, udder development and milk yield are reduced. This reduction in blood flow to the viscera is enhanced by lactation, because mammary blood flow is unaffected by peripheral vasodilation. Prediction equations can be developed to express the relationship between heat stress and reproduction in a particular environment, e.g. CR=388.3-4.62THI[17].

The impact of heat and humidity on milk production is inversely related to the amount of *Bos indicus* blood in the dairy cow[18]. Brief mention has been made of possible breed development in Brazil, but is not clear at this stage whether the *Bos indicus* genes should constitute 50% as in the Australian Friesian Sahiwal (AFS), 25% as in the Australian Milking Zebu, or 15% as in the Jamaica Hope. There is also a strong chance that the new tropical dairy breed will be displaced by HF genes from the temperate, almost polar latitudes, of North America and Europe. Such displacement should be based on performance, as was the case with the AFS in Queensland[19], although environmental considerations were probably not given as much weight as they would be today. It should not occur as a result of inadequate milk recording, sire evaluation and AI programmes, plus the importation of large numbers of HFs at a crucial stage in the development of the new breed, as was the case with the Jamaica Hope[20].

2.2 Environment

2.2.1 Forest destruction

During the past 20 years beef and milk production in Brazil has increased very slowly. This slow increase has been associated with the displacement of a large part of the cattle herd to increasingly marginal areas due to expansion of croplands. This process may have led to further encroachment on forest margins[21].

Forest margins are threatened due to displacement of the cattle herd to marginal areas by cropping

2.2.2 Savanna degradation

The degraded condition of the 40 million ha of planted grass pastures has already been noted (Section 2.1.1). The environmental effect of eroded, degraded pastures is compounded by their low productivity, and may contribute to further encroachment of forest margins. The remaining 160 million ha of the Cerrados includes about 12 million ha under annual crops, the rest being under native vegetation or monospecies forests and plantations (e.g. eucalyptus for charcoal)[22].

2.2.3 Intensive agropastoral production

Intensive agropastoral production has important environmental implications

An example of the current state-of-the-art intensive production system at a similar altitude (800m) and latitude (18°S) to Uberlandia can be found on the Atherton Tableland of North Queensland. There, HF dairy cattle are grazed on improved pastures which are irrigated and fertilized. This intensification of the industry has environmental implications, which are currently being investigated, namely: pollution of the local water catchments from fertilizer, emissions from the cattle and waste from dairy product processing. Similar developments have already been studied in Europe, where it has been found that the nitrogen loss increases with the intensity of the operation. Thus intensive dairy farms appear not to realize their higher production per ha by a more efficient use of their own soil and feed, but only by a bigger input of fertilizer and feed[23].

Unplanned incorporation of Bos taurus blood has negative implications on production and environment

The increasing proportion of *Bos taurus* blood results in a higher level of tick infestation which requires more frequent application of acaricides[24]. The sequel is usually an increasing resistance to pesticides, particularly in one host tick (e.g. *Boophilus* spp.)[25], and an increase in chemical contamination of dairy[26] and beef products which will compromise the development of local and export markets[27].

The perils of this *ad hoc* approach to livestock improvement and parasite control have been recognized elsewhere in the tropics and led to the Australian-African collaboration on tick ecology and epidemiology of tick-borne diseases[28]. The CLIMEX model developed from this collaboration has already been used to predict the spread of horn flies to Santa Catarina from neighbouring Brazilian states, and to help design control measures[29]. These measures include strategic rather than routine use of insecticides, and the use of dung beetles to control immature stages of the fly. Other biological agents, such as *Brachiaria brizantha*, have also been considered for tick control in Brazil[30].

2.3 Economics

2.3.1 Micro-economics

Research is needed on the economics of improving pastures as by products of profitable crops

The benefit of an improved pasture, generated as a byproduct of a profitable crop is recognized, as is the contribution of that pasture to the succeeding crop[31]. Nevertheless, there is a need to balance this improvement against the extra cost of acquiring machinery, more labour, and losing land to crop production in a ley farming rotation.

Environmental and economic trade-offs of intensifying milk and beef production need to be assessed

The development of an optimum genotype to utilise the improved forage production, without losing too much disease resistance and climate adaptation, has already been discussed along with the environmental implications (sections 2.1.2 and 2.2.3). The economic cost/benefit of these introductions must be included in the evaluation.

Dairy

Records are available from farms around Uberlandia, one of which has been "upgrading" from HF x Nellore crossbreds to 15/16 HFs to make better use of improved pastures created in a crop/pasture rotation. In addition, a study by the Universidade Federal de Uberlandia of the effect on milk production from HF crossbreds on improved grass-legume compared with grass pastures will lend itself to economic analysis.

2.3.2 Macro-economics

Beef

It is less clear how the improved animal nutrition should be exploited by the beef industry. In Brazil there is little reward for producing a premium product[32], although one might anticipate more demanding markets in the future. Therefore, at present, it is not a foregone conclusion that the economics of raising crossbreds from *Bos taurus* bulls will be better than producing younger *Bos indicus* beef. Some farmers around Uberlandia are already marketing young Nellore beef from improved pasture. The data is available for collection, analysis, and comparison in the future with marketing of crossbreds, which is anticipated before the end of the projects.

2.4 Global Relevance

The case study farms are considered to be representative of much of the Cerrados, which covers 200 million ha, an area of global dimensions in itself. Similar soil type and climate are to be found in the Colombian, Venezuelan, Bolivian and West African savannas, southern China and many countries of South East Asia[33].

The results will be used in the new CGIAR unified strategy of extending CIAT's pasture know-how to acid soils worldwide[37].

The Project emphasizes the areas of animal health, genetics, nutrition and economics, which are the priority and preserve of ILRI within the CGIAR system, and links them with the feed resources specialization of CIAT. Consequently this small collaborative project is the precursor of larger consortia linking CIAT, ILRI and other scientific institutions.

3.0 Objectives

3.1 Goal

This project is designed to fit within the **goal** of the CIAT Savannas Program which is to *develop alternative prototypes of production systems for the acid soil savannas which combine increased agricultural productivity with enhanced sustainability of the natural resource.*

The project is designed to complement rather than duplicate existing activities.

3.2 Objectives

(1) To assess the impact of pasture degradation and rehabilitation on biophysical and economic performance of Cerrados-based production systems.

(2) To reduce the beef industry's dependence on degraded, grass pastures;

(3) To optimise beef and dairy production from the new grass-legume technology at environmentally acceptable levels of agricultural inputs.

3.3 Outputs

The major outputs are:

(1) Cross-sectional analysis of current production systems;

(2) A causal model of pasture degradation and cattle production;

(3) Completed study on pasture management and beef cattle production;

(4) Completed study on cattle ecophysiology, health and husbandry;

(5) Completed final agricultural economic study on changes in the production systems.

From: Mark Winslow
To: DPACHICO
Date: Tuesday, January 31, 1995 12:59 pm
Subject: Germans

A couple of weeks ago, when I was still unsure what the next step was re: the German funding, I went ahead and drafted a cover letter (intended for RH) for submission with the Charting a New Course document.

It is attached. You may (or may not) wish to use parts of it in lobbying the Germans, particularly the summary list of special projects that the GTZ now funds.

Good luck!

CC: WRSCOWCROFT, RHAVENER

Files: C:\WPDOCS\LETTERS\GERMANS

DRAFT for Drs. Havener/Kramer

Dr. Ekkehard Kuerschner (or, who else?)
ATSAF
(Insert full address)

Dear Dr. Kuerschner,

(Greetings etc)

I am writing to follow up on a discussion you had with Dr. Fritz Kramer at Centers Week last October concerning the possibility of renewing the German contribution to CIAT's new inititative in environmental resource management. First of all, I would like to commend the vision and foresight your Government has shown over the last three years in joining us to advance this initiative, which is widely praised as an important and innovative new vision for international agricultural research. As you know, the entire CGIAR faced an unprecedented funding crisis during this period, and many difficulties still lie ahead. Your governments' support over the last three years was absolutely pivotal in enabling this initiative to start up and achieve its current strong momentum.

Allow me to very briefly review the background:

The CIAT Resource Management Initiative
There is little disagreement that the tropics of Latin America contain some of the world's most important and fragile ecosystems and biological diversity reserves, and they even play a crucial role in global climatic cycles. Increasing threats to these ecosystems are largely related to human interventions in agricultural land use and often driven by desperate poverty. During 1988-90, we embarked on intensive studies to determine how we might contribute to solving some of these problems. But we realized we could not do it without the support of concerned global donors.

With Germany's help and that of several other donors, CIAT's international position and skills in agricultural research and development were redirected to address these challenges. In the short time since our 1991 Strategic Plan, we have established major new interâinstitutional linkages and consortia in resource management research, and these have embarked on a vigorous research agenda. This effort is already producing important results, some of even worldwide importance - such as our recent discovery that improved tropical pastures can capture and store large amounts atmospheric carbon dioxide, a pollutant which is believed to play a key role in global warming.

To describe these events more completely, I am including a comprehensive report on the initiative (Charting a New Course), which covers its full start-up period of 1991-1994. It includes an executive summary and illustrations which quickly present an overview of the initiative.

Expanded Linkages with German Institutions
Linkages with advanced institutions in developed countries have enabled us to bring the most modern research methods and expertise into the initiative. The German support has helped us considerably in this regard, and created or reinforced a number of three-way linkages between ourselves, German research institutions, and institutions in Latin America, which we see as highly complementary partnerships for sustainable development. I would like to briefly mention these linkages below:

Soil Indicators of Sustainable Agropastoral Systems
This partnership links the Universität Bayreuth (Prof. W. Zech) with CIAT, Brazil's CPACâEMBRAPA (the national savannas research institution), and the International Fertilizer Development Center. The experience of the Universität Bayreuth on soil organic matter dynamics will be tapped to help identify factors which may be important indicators of sustainability. This will enable us to more accurately assess the potential of the promising new "agropastoral systems", which we believe can have enormous impact in regenerating degraded savanna soils.

Soil Degradation and Crop Productivity Research in Andean Hillside Farming
Erosion of precious topsoil is a major environmental catastrophe in the hillsides of the Andean mountains, where large numbers of rural poor make their livelihoods. This ongoing project between the University of Hohenheim (Prof. D. E. Leihner) and CIAT aims to better understand the biophysical processes leading to hillside erosion, particularly their effects on crop productivity. It is also searching for technologies appropriate to farmers' needs which can better protect the soil and increase its fertility.

Managing Acid Soils (MAS) Consortium
Acidic, weathered, infertile soils are widespread across tropical Latin America, and form a fundamental constraint to enhancing their sustainable use. CIAT convened a global consortium of institutions with experience and skills which could better elucidate the problems of these soils, and find solutions. Three German universities with expertise in soil science are members: Bayreuth, Göttingen and Hohenheim.

Sustainable Animal Production for the Agropastoral Systems of the Brazilian Cerrados
This project involves collaboration among Göttingen University (Prof. J. M. King), Deutscher Akademischer Austauscdienst (DAAD), CIAT, EMBRAPA, and the University of Uberlândia, Brazil. This project will study the benefits of pasture regeneration on animal

production, a major economic component in the Brazilian savannas. It will develop quantitative assessments of pasture degradation and rehabilitation, including cost/benefit analyses which are essential for increasing the adoption of these technologies. It will also compare the productivity of different cattle breeds in these new systems.

Further collaboration is currently being sought through two proposals recently submitted to BMZ:

Dynamics and Sustainability of Farming and Regional Systems in the South American Savannas
This project, a collaboration among the University of Hohenheim (Prof. W. Doppler), CIAT, CPAC-EMBRAPA and the University of Uberlândia, proposes to analyze the evolution of farming and other land use systems in the savannas, to better understand and quantify their impacts on the environment. This will lead to recommendations for more sustainable technologies and policies.

Calcium Acquisition and Utilization by Forage Grasses and Legumes
Calcium is one of the most important limiting nutrients in the acidic, low-fertility soils which predominate across the tropical savannas of Latin America. This project proposes collaboration with Prof. H. Marschner of Hohenheim University, to identify plant attributes which can enhance the ability of forage crops to acquire calcium from these soils, and using it more efficiently to produce biomass of high feed value.

These important linkages and projects clearly indicate the concern and committment of the German Government and institutions to helping the poor as well as in remediating environmental damage. We hope our own efforts in building these relationships and providing a platform for German involvement in Latin American resource management research have helped your country maximize the effectiveness of its foreign aid contribution on this high-priority topic.

The Future
The results achieved to date illustrate that the German investment over the last three years has been worthwhile and productive in establishing the basic linkages and capacity for a credible, science-based resource management initiative in Latin America. But what of the future? Resource management research is unquestionably a long-term undertaking, and can only achieve its potential if it receives sustained support. We depend on donors such as the Government of Germany to stay with us in support of this vision, and see it through to fruition.

I am thus appealing to you for your help in obtaining a renewal of the German core funding contribution to the resource management research initiative for the next three years. This

contribution would be applied to continue the drive along our core strategies and objectives as explained in 'Charting a New Course'. Very briefly, these encompass studies of land use trends related to degradation, and technologies for rehabilitation, in three critical tropical Latin American ecosystems: the hillsides, forest margins and savannas, in ways that also address the need to alleviate poverty. The emphasis is on top-quality biophysical and socio-economic research linked to development, a search for strategic principles that will have region-wide or even global impact, multi-institutional collaboration, and participation of local communities and farmers in the research agenda. If these features continue to meet the goals and criteria that the German Government wishes to apply in its development assistance, we doubt that a more effective vehicle than CIAT could be found for achieving them.

Dr. Kuerschner, in trying to stay brief I have risked overlooking some important questions you may have. If so, or if you would like any additional information and documentation of our past work, please do not hesitate to contact me. We seek your advice and counsel about ways and means to continue strengthening the Germany-CIAT relationship. By working together, I believe that CIAT and Germany can and will continue to make impressive progress towards the goal of improving the way natural resources are managed in Latin America and the Caribbean.

Sincerely yours,

Dr. Robert D. Havener
Director General

c.c. Prof. Dr. Rudolf Casper
Dr. F. Kramer
Dr. D. Pachico
Dr. W. Scowcroft

4.0 Work Plan

4.1 Project Description

Five interrelated studies will be undertaken by research students who have already graduated in agricultural, economic, animal and/or veterinary sciences. Two of the three DAAD sponsored M.Sc. studies have already started their field work. The third M.Sc. study requires at least three years to elapse before results from current development can be measured. The two Ph.D. studies, for which funding from BMZ has been requested, are timed to fit between the initial and final M.Sc. studies.

Graduates, taking higher research degrees at Göttingen are expected to go through the whole research process themselves so that they are educated to become research scientists and not just instructed and practiced technicians. So it is inappropriate for the project leader or professors to generate the hypotheses which in turn dictate the methodologies by which they will be tested. This research education ethic has to be made compatible with the demands of development research, which in itself is good training.

A proposed structure linking project activities to project outputs is shown in Figure 1. Thus the students are expected to:

- examine the main components of the existing agropastoral systems;
- define its baseline;
- measure "improvements" as they are introduced;
- predict their effects;
- extrapolate the results from the case-studies to the Cerrados as a whole.

The information they obtain will assist the Program to suggest appropriate pathways for the development of the tropical savannas.

Figure 1

Project Description

Structure Linking Project Activities to Project Outputs

Program Goal

To develop alternative prototypes of production systems for acid-soils savannas which combine increased agricultural productivity with enhanced sustainability of the natural resource base.

Project Purpose

To assess the impact of pasture degradation and rehabilitation on biophysical and economic performance of Cerrados-based production systems in Brazil.

Project Outputs

Activities

Cross-sectional analysis of current production systems (Benchmark Study)	**A causal model of pasture degradation and cattle production**	**Completed study of pasture management and beef cattle production**	**Completed study on cattle ecophysiology, health and husbandry**	**Completed final agricultural economic study on changes in the production systems**
→ Collection of available information on animal production in Uberlandia.	→ Preliminary selection of study areas in two soil types.	→ Evaluation of soil changes on degraded pasture.	→ Relate differences in the feed resource to cattle performance.	→ Micro-economic study of crossbred beef production on new grass-legume pastures.
→ Selection of case study production systems.	→ Field inspection and interviews with farmers.	→ Measurements of plant and animal production.	→ Relate variations in disease challenge to cattle performance.	→ Micro-economic study of pure HF doing cattle on new grass legume pastures.
→ Data collection on selected farms.	→ Evaluation of soil, chemical and biological properties of selected pastures.	→ Creation of standardized data sets to estimate productivity indices.	→ Measure and map the thermal environment.	→ Extrapolation of the on-farm case studies to the Cerrados as a whole.
→ Calculation of net farm income and economical profitability of current production systems.	→ Determination of plant growth factors.	→ Feed conversion efficiency at the production system level.	→ Relate operative temperatures and humidity to cattle performance.	→ Macro-economic study on the response of markets to developments in the production system.
	→ Assessment of current		→ Compare performance of cattle genotypes in relation to nutrition, climate and disease.	

4.1.1 Cross-sectional analysis of current production systems

This will be a short term, cross-sectional analysis of current production systems, requiring six months of field work by an M.Sc. student from Göttingen university, with a Scholarship from DAAD and local support from CIAT and EMBRAPA.

The field work started in October 1994, to test the hypotheses that traditional livestock production systems based on stractivism and low use of inputs are not profitable in terms of farm business and that the use of improved pasture and crop-pasture systems are economically feasible in more intensive management systems.

Activities include:

- Collection of available information of animal production in current production systems in the Uberlandia region.
- Selection of a range of production systems including degraded pastures, grass-legume pastures and crop-pasture systems in similar soil type to conduct case studies.
- Collection and processing of available information on use of inputs, animal and crop production in the selected farms.
- Calculation of net farm income, gross margins and economical profitability of each production systems.

Secondary Outputs from the study will include:

- Cost/benefit analyses of current degraded pastures and new crop-pasture systems on existing livestock genotypes.
- Objective economic criteria to help farmers to select the animal production system(s) best suited to their needs.

4.1.2 Causal model of pasture degradation and cattle production

This is the research subject of an M.Sc. from Göttingen university, funded by DAAD, with local support from CIAT and EMBRAPA. Field work started in October 1994.

Testing the hypotheses that pasture degradation can be categorized and related to decreased animal production, has required the following activities:

Activities include:

- Preliminary selection of study areas in two soil types (clay and sandy) using available information (satellite images, air photographs and soil maps).
- Field inspection and interviews with farmers to select pastures under several stages of degradation.
- Evaluation of soil chemical, physical and biological properties of selected pastures along a toposequence.
- Determination of the plant growth factors (canopy, growth rates, and nutrient content) in relation with the stage of degradation.
- Assessment of current animal management (actual and potentially adequate stoking rates) and animal outputs in relation to the conditions of the pasture.

Secondary Outputs from this study will include:

- Selection of benchmark sites to study pasture degradation processes.
- Baseline information about relationships between soil-plant and animal factors in degraded pastures.

4.1.3 Study of pasture management and beef cattle production

This BMZ-funded Ph.D. study will include 27 months of field work, to allow for the development of appropriate methods and their application to seasonal climatic variation within and between years. It will be built on the preliminary study described in Section 4.1.2.

Activities will include:

- Evaluation of changes in soil chemical, physical and biological properties of selected degraded pastures over time.
- Measurements of plant and animal production.
- Creation of standarized data sets to estimate productivity indices and analysis of information using the LIMS developed by ILCA.
- Feed conversion efficiency at the production system level using the LPEC computer model created at Reading University.
- Testing the value of reversal treatments, which fall short of the more drastic commitment to crop-pasture rotation.

Secondary Outputs from this study will include:

- the characterization and quantification of the process of degradation in planted grass pastures;
- clarification of the scope for pasture recovery at different stages of degradation;
- generation of a causal model of pasture degradation;
- establishment of the relationship between pasture degradation and the decline in animal production;
- provision of the benchmark against which developments in pasture management and beef cattle husbandry can be measured.

4.1.4 Completed Study on cattle ecophysiology, health and husbandry

The other BMZ funded Ph.D. study will also include 27 months of field work, to allow for the development of appropriate methods and their application to seasonal climatic variation within and between years.

The study will focus on the direct effect of climate on production, from which it will be necessary to separate other factors such as feed resource, and disease.

Activities will include:

- relating differences in the feed resource to cattle performance;
- relating variations in disease challenge, notably tick-borne disease, to cattle performance;
- measuring and mapping the thermal environment from the perspective of cattle. It will require further research into appropriate indices, e.g., relating solar heat load, ambient temperature and humidity, and construction of measuring equipment including globe thermometers, temperature and humidity probes linked to thermocouples.
- relating the operative temperatures and humidity to cattle performance;
- comparing the operative temperatures and humidity to cattle performance;
- comparing the performance of existing and recently introduced cattle genotypes and crossbreeds in relation to nutrition, climate and disease;
- looking for indicators (e.g., behavioral or physiological) which are associated with a loss in performance;
- measures of performance will include growth and milk production in the short term, productivity indices and feed conversion efficiency (using LPEC) in the longer term.

Secondary Outputs from this study will include:

- redefined limits to animal production using existing beef and dairy cattle genotypes, based on improved grass-legume pastures;
- description of constraints, in terms of nutrition, climate and disease, to animal production from new cattle genotypes in the improved ley-farming system;
- predicted scope for increase in animal production using these introduced genotypes;
- description of the ecological implications of more intensive management associated with these new cattle breeds;
- suggested limits to chemical inputs to minimize pollution;
- recommended genotypes and husbandry practices appropriate to the improved ley-farming system.

4.1.5 Completed final agricultural economic study on changes in the production systems

This will be a short term, cross-sectional analysis of the changes in the production systems which have occurred during the project. It will include six months of field work and be appropriate for an M.Sc. study at the University of Göttingen by a student from Brazil funded by DAAD.

Activities will involve a micro-economic study of:

- crossbred beef production on new grass-legume pastures;
- pure HF dairy cattle on new grass-legume pastures;
- extrapolation of the on-farm case studies to the Cerrados as a whole;
- a macro-economic study of the initial response of the markets to the developments in the production system.

Secondary Outputs from this study will include:

- cost/benefit of introduced livestock genotypes in the new ley-farming system;
- comparison of the new with the old systems using results from the initial economic survey;
- recommendations for cattle production systems appropriate to the new grass-legume technology;
- quantification of the likely impact of their adoption throughout the Cerrados;
- prediction of market developments.

4.2 Anticipated Project Impact

The consequences of the project outputs vary with the beneficiaries targeted, which include:

4.2.1 Collaborators

Planned activities will complement concurrent studies on pasture degradation and animal production in new grass-legume pastures conducted by EMBRAPA and the University of Uberlandia (Appendix A and B). Laboratory facilities to help in the characterization of soil-plant factors related to pasture degradation and improvement are available at CPAC. Field facilities to assess the impact of improved grass-legume pastures on dairy production are available at the University of Uberlandia. Staff from both institutions will participate in planning and interpretation of results obtained by the students.

The results on animal production and economic perspectives of improved ley farming systems derived from this projects will complement the studies of the BMZ-funded CIAT-Bayreuth-EMBRAPA/CPAC project on soil organic matter in various cropping systems including degraded and rehabilitated pastures.

The design of more profitable and sustainable agropastoral systems than the present ones, will benefit collaborating farmers around Uberlandia and spread to their neighbours by the "ripple effect".

4.2.2 Client Groups

Active extension of the results by EMBRAPA, the NARS counterpart to CIAT in this project, to the four states in the Brazilian Cerrados will increase national beef production by about 40%, rice by 20%. No estimates are available for dairy production but one may assume a similar impact on the supply of milk products particularly for the expanding cities of the savannas.

The description of a set of key variables which affect the plant, animal and economics of the production system will help to assess the transferability of the results to other tropical savannas.

4.2.3 Community

The ultimate beneficiaries will be the urban poor whose staple foods of rice, beans, milk and beef (which 70% of the population can no longer afford) are produced mostly in savanna region. The project will help to stop the drift of people from the countryside to the cities, which already contain 80% of the population in the south eastern part of the Cerrados[22]. It will make farming a more viable enterprise, and raise the living standards of the agricultural labourer.

4.2.4 Environment

The Cerrados will benefit from the creation of agricultural production systems using plant and animal genotypes, which do not require what are now considered to be environmentally unacceptable levels of chemical input to express their potential. These gains in animal production will be achieved without further destruction of the Brazilian rainforest.

4.3 Location, Duration & Timing

4.3.1 Location

The development of the project has been done by the CIAT Headquarters in Cali, the EMBRAPA-CIAT office in Brasilia, and the Tropical Animal Husbandry Group, University of Göttingen. CIAT, Cali will integrate this project with others in the Savannas Program. The EMBRAPA-CIAT office in Brasilia will co-ordinate the field work with other projects based on the same farms around Uberlandia. The Tropical Animal Husbandry Group, University of Göttingen will be responsible for the academic requirements of the research students.

The field work will be done on farms around the town of Uberlandia in the State of Minas Gerais, Brazil. A joint EMBRAPA-CIAT[34] agroecological characterization of the Cerrados of Brazil has indicated that the area within a radius of 60 km of the town includes six different agroecological classes found throughout the Cerrados. Five of these classes represent approximately 50% of the area of the Cerrados which has been surveyed, or a total of 500, 000 km^2.

4.3.2 Duration and timing

The BMZ contribution to the project is two Ph.D. studies on Pasture Management and Beef Cattle Production, and Cattle Ecophysiology, Health and Husbandry, sandwiched between Initial and Final Pasture Management and Agricultural Economic M.Sc. studies. The costs of the M.Sc. studies will be met largely through support from DAAD for the course in Tropical Agriculture and Forestry at the University of Göttingen. Therefore, the BMZ funding requirement is confined to the three middle years (from mid 1995 to mid 1997) of a project which starts in 1994 and ends in 1998.

4.3.3 Implementation Schedule

Figure 2 shows the implementation schedule.

4.3.4 Project Management

The Project Organization Chart is shown in Figure 3.

FIGURE 2

Implementation Schedule of Activities by Quarter (Q)

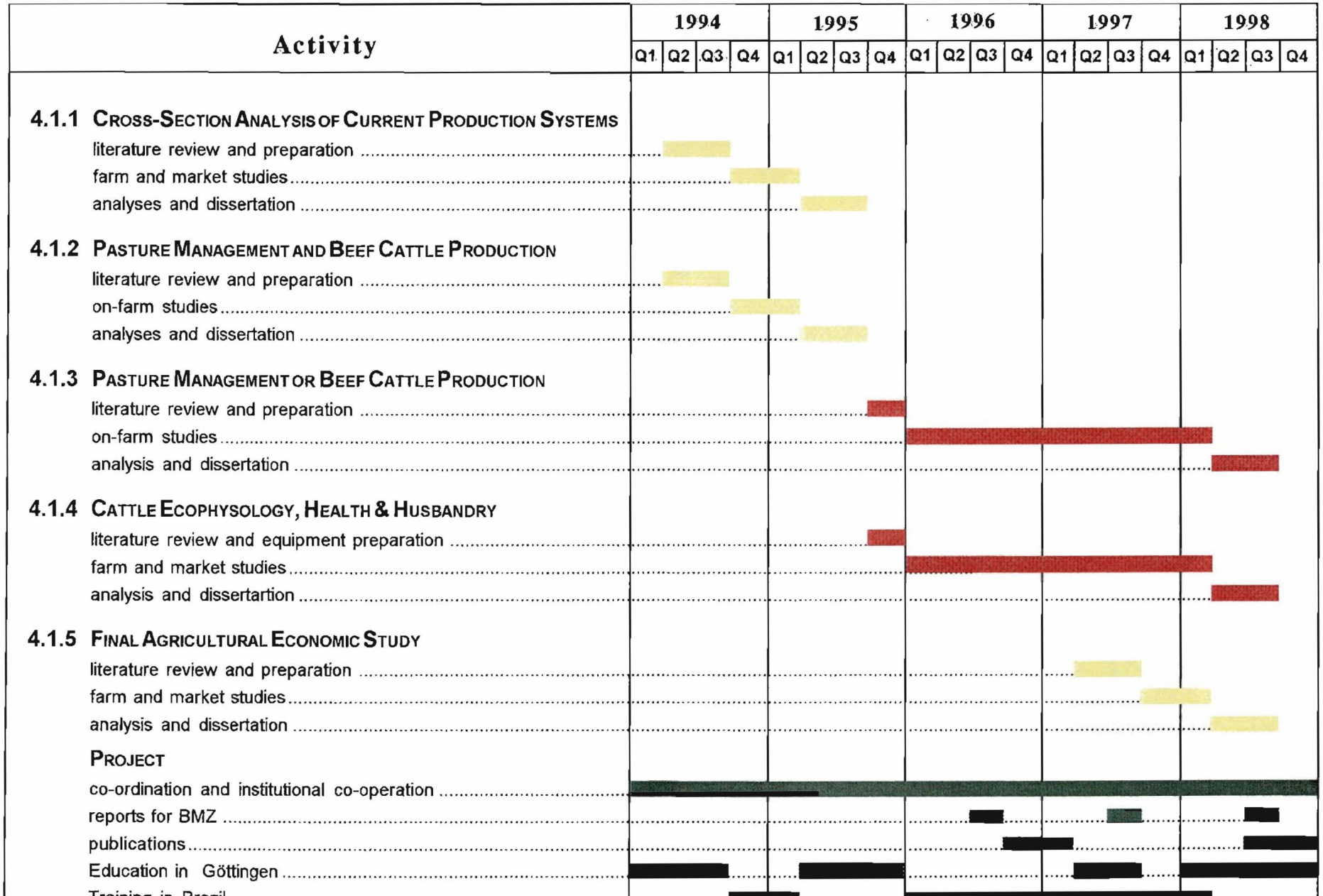
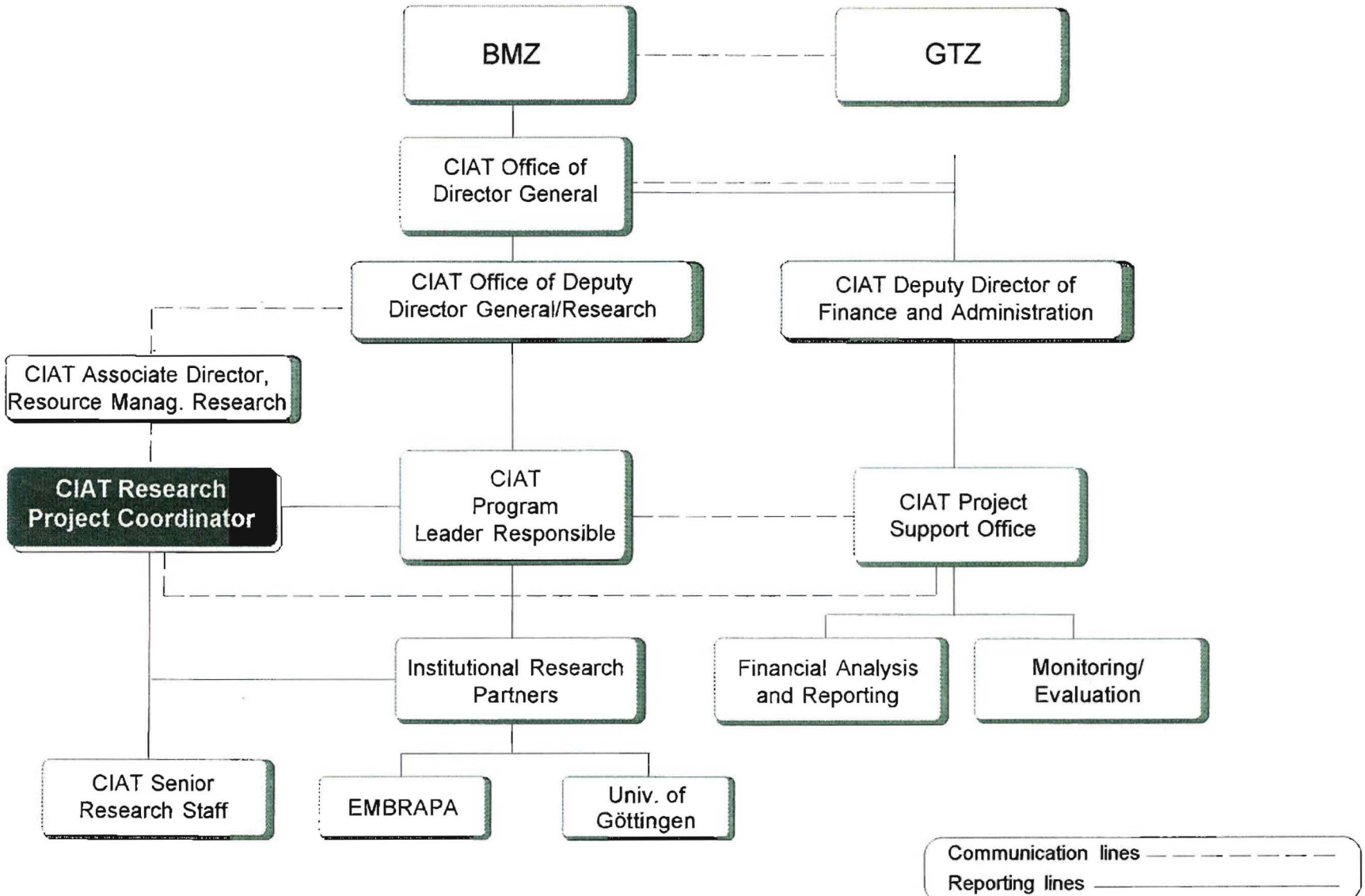


Figure 3

Project Organization Chart



5.0 Training

Both German and Brazilian graduate students will receive the opportunity for advanced training.

Female participation in the training component will be sought.

Students from Göttingen, Uberlandia and other Brazilian Universities will have the opportunity to be selected.

The first two M.Sc. studies are being done by German graduate students who have completed their course work at Göttingen University. The final M.Sc. study will be offered first to a Brazilian graduated from Uberlandia or another University or the NARS.

Application for the two Ph.D. studies will be invited from Brazilian and German students if funding is secured.

6.0 Expected Patentable Results

CIAT and the University of Göttingen endorse the principle of free access to research results, through publication of research findings in international journals and in-house papers.

There are no patentable results anticipated from this project.

7.0 Required Resources and Budget

The project budget supports three M.Sc. and two Ph.D. students from the course for Tropical Agriculture at the University of Göttingen, involving four or five students from Brazil and Germany. The research students will be assisted by one local Brazilian graduate and two field workers. They will receive expert advice and supervision from specialists in economics, soil, pasture and animal science from CIAT, EMBRAPA and the Universities of Uberlandia and Göttingen.

The cost of the M.Sc. studies will be met by DAAD. The project will pay the stipends of the two Ph.D. students, the graduate assistant and two field workers employed locally in Brazil. It will cover operating costs in Brazil, and the provision of field equipment, computer and laboratory analysis in Brazil, Colombia and Germany. It will pay for local and international travel of students and their supervisors. There will also be a funding requirement for seminars publications and report writing, which increases in the final year of the project.

Funds requested from BMZ are required from the time of recruitment of the Ph.D. students, planned for mid 1995, until completion of their studies, estimated to be 3 years later. A breakdown of the budget between the three main collaborating organizations over the three core years of the project is given in Table 1.

Table 1

Centro Internacional de Agricultura Tropical – CIAT
BMZ – Sustainable Animal Production For the Agropastoral Systems Of the Brazilian Cerrados
Proposed Budget in US$ dollars

Line item	Year 1	Year 2	Year 3	Total
CIAT				
Personnel	27,750	29,150	30,650	87,550
Travel	11,400	12,000	12,600	36,000
Research and operation	13,500	10,000	10,500	34,000
Inter–institutional cooperations	5,700	6,000	6,300	18,000
Vehicle lease	8,550	9,000	9,450	27,000
Indirect costs	10,050	9,900	10,450	30,400
TOTAL CIAT	**76,950**	**76,050**	**79,950**	**232,950**
EMBRAPA				
Training	2,850	3,000	3,150	9,000
Research and operation	1,900	2,000	2,100	6,000
Inter–institutional cooperations	7,600	10,000	10,400	28,000
Travel	5,000	7,500	7,500	20,000
Indirect costs	2,255	2,925	3,010	8,190
TOTAL EMBRAPA	**19,605**	**25,425**	**26,160**	**71,190**
GÖTTINGEN UNIVERSITY				
Personnel	85,500	97,900	85,700	269,100
Travel	22,500	11,400	22,200	56,100
Training	22,550	–	–	22,550
Research and operation	34,000	7,100	6,200	47,300
Publications and seminars	–	–	3,300	3,300
Indirect costs	24,700	17,450	17,600	59,750
TOTAL GÖTTINGEN UNIVERSITY	**189,250**	**133,850**	**135,000**	**458,100**
TOTAL ALL PARTNERS	**285,805**	**235,325**	**241,110**	**762,240**

BMZ-SUS-A
17-Jan-95
PROPOSED

Juan A. Garafulic
Financial Controller

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Appendix A

EMBRAPA - EMPRESA BRASILEIRA DE PESQUISA AGROPECUARIA EMISSAO: 13,
DPD - DEPARTAMENTO DE PESQUISA E DIFUSAO DE TECNOLOGIA
RELATORIO EMISSOR DO ESPELHO DO PROJETO
SINSEP - SISTEMA DE INFORMACAO DO SEP PAGINA:

CODIGO DO PROJETO: 01.0.94.335
TITULO:Recuperação e renovação de pastagens cultivadas

PROJETO VINCULADO AO PROGRAMA:01 RECURSOS

LIDER DO PROJETO: 308.455.801-91 - BARCELLOS, A.O.
DATA DE ELABORACAO: 15/12/93 PERIODO: 01/94 A 12/98
UNIDADE COORDENADORA: 00223008 - CPAC

UNIDADES PARTICIPANTES

00170084 EBDA	00170100 EPAMIG	00202002 CNPAF
00204008 CNPGC	00205005 CNPGL	00207001 CNPMS
00209007 CNPSO	00223008 CPAC	00235002 CPAO
01303007 UFV	04601019 IZ	07002009 IICA
07005002 CIAT	00204008 CNPGC	00205005 CNPGL

RESUMO DO PROJETO

A pecuária de corte e leite, atualmente implantada na região Centro Oeste do Brasil, é responsável por 44% do rebanho do pais. Esta atividade é desenvolvida em diferentes intensidades de exploração entretanto, a base alimentar dos animais é suportada por pastagens. Dados publicados pelo IBGE (1985) fazem referência a existência de cerca de 30,2 milhões de hectares de pastagens cultivadas. A mesma fonte demonstra que o início da grande expansão da formação das pastagens ocorreu na década de 70, coincidindo com os Programas de Desenvolvimento dos Cerrados (POLOCENTRO). Nesta mesma ocasião ingressaram no país gramíneas do género Brachiaria que , em função do alto grau de adaptação, foram amplamente difundidas e adotadas pelos produtores. As práticas para formação e manejo adotadas na utilização destas pastagens, ao longo dos anos, foram determinantes para que surgissem extensas áreas com elevada perda da capacidade produtiva. Estima que cerca de 50% da área de pastagens cultivadas na região dos Cerrados encontra-se em algum patamar de degradação. A acentuação do processo de degradação das pastagens é função do acúmulo do efeito dos fatores responsáveis tais como: manejo inadequado; falta de adubação de manutenção; presença de invasoras; compactação superficial e ataque de pragas, principalmente a cigarrinha das pastagens; e uso indiscriminado do fogo. Entre os varios fatores responsáveis pela degradação, a carência nutricional, em especial de fósforo e nitrogênio, parece ser uma das mais importantes. As observações e contatações, verificadas anteriormente, não são restritas ao ambiente Cerrados, tendo em vista que o histórico da expansão da pecuária no Brasil, e por consequência das pastagens cultivadas, é muito semelhante. Exemplo claro constata-se na exploração pecuária na denominada unidade geomorfológica dos Tabuleiros Costeiros, que ocupam uma superficie de mais de 3100 km2 nos estados da Bahia,

Sergipe, Alagoas e Pernambuco. Existem evidências que é bioeconomicamente viavel recuperar ou renovar pastagens degradadas. Seria necessário, para tanto, monitorar e identificar as causas da degradação e desenvolver processos agronômicos e tecnologias para viabilizar, nos diferentes sistemas de produção, as estratégias para recuperação ou renovação das pastagens. Desta forma, seria possivel reaver e incrementar a capacidade produtividade da exploração pecuária, reduzindo a pressão existente em relação a abertura de novas áreas em busca da manutenção da produção. Outros reflexos diretos seriam obtidos na conservação dos recursos naturais.

DEMANDA GERADORA

Utilização racional e preservação dos recursos naturais de água, solo e vegetação de modo a manter a capacidade produtiva dos diversos agro-sistemas.

OBJETIVOS

-Levantamento da área total de pastagens degradadas na região dos Cerrados e seu nivel de degradação

-Identificação dos componentes bióticos e abióticos responsáveis pela degradação de pastagens na região dos Cerrados

-Identificação de cultivos associado a germoplasma e práticas agoronômicas para viabilização econômica e técnica para recuperação de pastagens.

-Determinação da capacidade produtiva de pastagens recuperadas, longevidade e ciclos de recuperação a nível da propriedade.

-Identificação de parâmetros para tomada de decisão de quando e como renovar ou recuperar pastagens.

-Identificar estratégias para recuperação de pastagens em solos arenosos
e com declividade (não aptos a agricultura).

- Conservação e utilização dos recursos naturais e insumos com vista a sustentabilidade dos sistemas de produção.

- Validação e Transferência de tecnologia geradas no âmbito do projeto.

Appendix B

CONTRIBUIÇAO EFETIVA DO DEPARTAMENTO DE PRODUÇAO ANIMAL DA UNIVERSIDADE FEDERAL DE UBERLANDIA DENTRO DO PROJETO "PRODUÇAO ANIMAL SUSTENTAVEL EM SISTEMAS AGRO PASTORIS NO CERRADO BRASILEIRO"

INTRODUÇAO

O Departamento de Produção Animal, na área de Bovinocultura de Leite, realiza trabalho de pesquisa para avaliar e testar forrageiras tropicais para produção de leite à nível de pasto, na região de Uberlândia por entender que as potencialidades das forrageiras tropicais refletiriam níveis de produção de leite superiores às atuais médias verificadas de 3,0 kg/animal/dia. Uberlândia produz 40% da produção total do leite do cerrado brasileiro, sendo que 83% desta produção advém de pequenos produtores (até 200 kg/dia). O que se espera é encontrar modelos ou sistemas de produção que se adequem às condições de produção de leite, principalmente no período de verão chuvoso (outubro a abril). Concomitantemente, testa-se alternativas com plantas tropicais (gramíneas e leguminosas), que plantadas nos meados do período chuvoso, darão alimento no período seco do ano (maio-setembro).

O Departamento de Produção Animal utiliza de uma Fazenda Experimental com área de 600 ha, caracterizada por latossolo amarelo areno-argiloso, cuja vegetação é de "campo sujo", na qual já se produz 1.400 kg de leite pro dia, com um rebanho de aproximadamente 230 animais, sendo que em lactação, 90-100 fêmeas. Na área de Nutrição Animal, trabalham, direta e indiretamente, quatro professores, dos 34 existentes no Departamento. Além das fazendas, laboratórios de Nutrição e de Análise de Leite, contribuem decisivamente na avaliação da qualidade das forragens e do leite, respectivamente. Participam das atividades de pesquisa 120 estudantes do curso profissionalizante, por meio de bolsas de iniciação científica e de aperfeiçoamento cedidas pelo Centro Nacional de Pesquisa do Brasil. Além de pesquisa os estudantes são envolvidos em projetos de desenvolvimento social e intelectual dos pequenos produtores rurais, através dos estudos de caracterização, diagnósticos e melhoramento dos sistemas produtivos.

ATIVIDADES

Isso posto e para atingir os objetivos almejados pelo projeto principal, o Departamento analisaria:

. Os principais componentes dos sistemas agropastoris já existentes
. estabeleceria a relação entre pastos degradados e a produção animal;
. estudaria a interação genótipo-ambiente e seu efeito na utilização de ecossistemas de pastagens;
. identificaria indicadores e qualidade das pastagens e da produção animal em pastos degradados e melhorados.

ORÇAMENTO

. Experimentos de campos, incluindo preparação dos bovinos; estabelecimento e manutenção das pastagens experimentais. Do recurso total, 20% será para este propósito.
. Análises laboratoriais, que inclui equipamentos, pessoal e reagentes. Serão necessários 80% do total disponível dos recursos.
. Transportes - deslocamento de pesquisadores e estudantes às áreas de trabalho. Serão necessários 10% do recurso total.

Coordenador das atividades pela Universidade Federal de Uberlândia será o Prof. Edmundo Benedetti.

PROF. EDMUNDO BENEDETTI
Departamento de Produção Animal
Av. Pará, 1720 - Campus Umuarama
38400-902 - Uberlândia-MG

PROF. MIGUEL ANGEL AYARZA
Coordenador do Projeto Principal
no Brasil - CIAT

Appendix C-1

CIAT C.V.

Centro Internacional de Agricultura Tropical
International Center for Tropical Agriculture

Raúl R. Vera

Position in Project:

Project Supervisor, Leader, Tropical Lowlands Program

Management and Administrative Experience:

Centro Internacional de Agricultura Tropical (CIAT)
Leader, Savannas Program
Cali (1992 - present)

Centro Internacional de Agricultura Tropical (CIAT)
Leader, Tropical Pastures Program
Cali (1990 - 1992)

International Research Experience:

Centro Internacional de Agricultura Tropical (CIAT)
1981-present

Research on savanna production systems and the role of forages in cattle systems in Brazil, Colombia, Ecuador and Perú.

Teaching and Thesis Supervisory Experience:

- Teaching various courses in CIAT
- Supervision of several thesis including Ph.D., M.Sc. and B.Sc. at CIAT
- Associate Professor, Universidade Federal de Minas Gerais, Belo Horizonte, MG, Brazil (1977 - 1981)
- 1969-1973 Assistant Professor, U. Nacional del Sur, Bahía Blanca, Argentina.

Professional Memberships:

- British Grassland Society
- Asociación Latinoamericana de Producción Animal (ALPA)

Education:

Ph.D., Nutrition with minor in Biomathematics
University of California
Davis, 1976.

M.S., Animal Science
University of California
Davis, 1968.

B.Sc., Agriculture
Universidad de la República
Uruguay, 1966.

Languages:

Spanish	- Native
English	- Native
Portuguese	- Fluent
French	- Reading

Citizenship:

Uruguayan

Country of Residency:

Colombia

Major Publications and Report:

Editor of three books:

(1) Sistemas de Producción Pecuaria Extensiva: Brasil, Colombia, Venezuela - Proyecto ETES. 530p. 1985.

(2) Panorama de la Ganadería de Doble Propósito en la América Tropical. 313p. 1989.

(3) *Andropogon gayanus* Kunth: a grass for tropical acid soils. 406p. 1989.

Publications:

see list enclosed (see page 35)

Appendix C-2

CIAT
Centro Internacional de Agricultura Tropical
International Center for Tropical Agriculture

C.V.

Miguel Angel Ayarza

Position in Project:

Coordinator in Brazil/Soil Scientist

Management and Administrative Experience:

Centro Internacional de Agricultura Tropical (CIAT)
Cali, Colombia, 1992- present
Savanna Program

Coordinator of outposted activities

International Research Experience:

North Carolina State University
Yurimaguas, Perú, 1984-1986
TropSoils Mission

Research on pasture production and fertility

Centro Internacional de Agricultura Tropical (CIAT)
Cali, Colombia, 1989, 1992-present
Research Fellow Pasture and Savanna Programs

Research on soil fertility especially phosphorus in acid oxisols.

Centro Internacional de Agricultura Tropical (CIAT)
Planaltina, Brasil
1992 - present
Senior Research Fellow Savanna Program

Research and coordinating activities with EMBRAPA-CPAC on agropastoral systems in the cerrados. Research on soil fertility and site selection using rapid rural surveys

Teaching Experience:

Centro Internacional de Agricultura Tropical (CIAT)
Cali, Colombia (since 1989)
Instructor / lecturer in courses on tropical pasture management.

Supervisor of various under-graduate research projects.

Professional Memberships:

- Soil Science Society of America
- Colombian Soil Science Society

Awards, honors:

- British Council Scholarship 2 years (1978 - 1980)
- Rockefeller Foundation Scholarship 4 years (1982-1986)

Education:

Ph.D. Soil fertility
North Carolina State University, 1986

M.Sc. Soil Science
University of Reading, U.K., 1980

B.Sc. Agronomy
National University of Colombia, 1974

Languages:

Spanish	-native
English	-fluent
Portuguese	-fluent

Citizenship: Colombian

Country of Residency: Brazil

Publications: See list enclosed (page 35)

Recent Relevant Publications from CIAT

Ayarza, M.A. 1991. Efecto de las propiedades quimicas de los suelos acidos en el establecimiento de las especies forrajes. In: C.E. Lascano and J.M. Spain (eds.), Establecimiento y renovacion de pasturas. pp. 161-185. CIAT, Cali, Colomiba.

Ayarza, M.A. and Spain, J.M.. 1991. Manejo del ambiente fisico y quimico en el establecimiento de pasturas mejoradas. In: C.E. Lascano and J.M. Spain (eds.), Establecimiento y renovacion de pasturas. pp. 189-208. CIAT, Cali, Colombia.

Thomas R.J. (1992) The role of the legume in the nitrogen cycle of productive and sustainable pastures. Grass and Forage Science 47, 133-142.

Thomas, R.J., Lascano, C., Sanz, J.I., Ara, M., Spain, J., Vera, R. and Fisher, M.J. (1992) The role of pastures in production systems. In "Pastures for the tropical lowlands: CIAT's contribution". p123-146. CIAT.

Thomas, R.J., Fisher, M.J., Lascano, C., Rao, I.M., Ayarza, M. and Asakawa, N. (1993) Nutrient cycling via forage litter in tropical grass/legume pastures. XVII International Grassland Congress, New Zealand/Australia, Feb 8-21, 1993.

Miles, J.W., Thomas, R.J., Lascano, C., Fisher, M.J., Vera, R. and Sanz, J.I. (1993) Evaluation of *Stylosanthes* for selected farming systems of tropical America. African Livestock Research Journal in press.

Fisher, M.J., Lascano, C.E., Thomas, R.J., Ayarza, M.A. and Rao, I.M. (1993) An integrated approach to soil-plant-animal interactions on grazed legume-based pastures on tropical acid soils. XVII International grassland Congress, New Zealand/Australia, Feb 8-21, 1993.

Rao, I.M., Ayarza, M.A., Thomas, R.J., Fisher, M.J., Lascano, C.E. and Borrero, V. (1993) Adaptation responses of tropical grass-legume associations in acid soils. XVII International Grassland Congress, New Zealand/Australia, Feb 8-21, 1993.

Vera, R.R., Thomas, R.J., Sanint, L. and Sanz, J.I. (1993) Development of sustainable ley-farming systems for the acid-soil savannas of tropical America. In "Ecology and Sustainable Agriculture in Tropical Biomes" Rio de Janeiro, Feb 3-6, 1992. FAO Publns in press.

Thomas, R.J. and Asakawa, N.M. (1993) Decomposition of leaf litter from tropical forage grasses and legumes. Soil Biology & Biochemistry, in press.

Rao, I.M., Ayarza, M.A., Thomas, R.J., Fisher, M.J., Sanz, J.I., Spain, J.M. and Lascano, C.E. (1992) Soil-plant factors and processes affecting productivity in ley farming. In "Pastures for the tropical lowlands: CIAT's contribution" p.145-175, CIAT.

Ayarza, M.A., Rao, I.M., Thomas, R.J., Fisher, M.J., Lascano, C.E. and Herrera, P. 1993. Standing root biomass and root distribution in *Brachiaria decumbens/Arachis pintoi* pastures under grazing. XVII International Grasslands Congress, New Zealand/Australia, Feb 8-21, 1993.

Thomas, R.J. 1993. Rhizobium requirements, nitrogen fixation and nutrient cycling. In "Workshop on *Arachis*" CIAT May 25-28, 1993 in press.

Thomas, R.J., Fisher, M.J., Ayarza, M.A. and J.I. Sanz. 1993. The role of forage grasses and legumes in maintaining the productivity of acid soils in Latin America. Advances in Soil Science. in press 1994.

Thomas, R.J. and Lascano, C.E. 1994. The benefits of forage legumes for livestock production and nutrient cycling in pasture and agropastoral systems of acid-soil savannas of Latin America. In "Livestock and sustainable nutrient cycling in mixed farming systems of sub-Saharan Africa." Nov 22-26, 1993.

Appendix C-3

CIAT
Centro Internacional de Agricultura Tropical
International Center for Tropical Agriculture

C.V.

John Michael King

Position in Project:

Coordinator in Germany

Management, Administrative and Research Experience:

University of Göttingen, Germany
1993 - present
Professor of Animal Husbandry and Breeding in the Tropics and Subtropics.

Queensland Department of Primary Industries
1990-1992
Director, Division of Forage and Animal Management

Responsible for scientific excellence and careers of 235 scientific staff, contracting their services to Departmental programs, and providing policy counsel to Minister in area of expertise.

Regional Executive Officer, North Queensland (0.5 million km^2). Coordinated 500 staff from 30 Branches of Agricultural Production and Marketing, Land Use and Fisheries, located in 20 offices and research stations.

University of Western Australia, School of Agriculture
1988-1990
(Australian Meat Research Corporation)
Senior Research Fellow, initiated and obtained funding for project on meat-lamb production from fine-wooled sheep.

Research on soil fertility especially phosphorus in acid oxisols.

UK Overseas Development Administration
1985-1988
Animal Health and Husbandry Adviser to *Jordan Government.*
Head of Jordanian/UKODA/Australian Dry Land Farming Sheep Husbandry and Health Program.

1984 Consultant on water development in grazing areas of northern Kenya for **UNESCO Integrated Project on Arid Lands** and on aerial survey for **ILCA**.

- Senior Animal Scientist, Central Scientific Unit, Addis Adaba.
- Senior Animal Scientist, Range Livestock Systems Studies in Kenya.
- Coordinator of ILCA reviews on: "The Water Resource of Tropical Africa and its Exploitation", "Organization and Management of Water Supplies", and author of "Livestock Water Needs in relation to Climate and Forage".

FAO/IAEA
1974-1980
Member of Coordinated Research Programme on the Water Requirements of Tropical Herbivores using Tritiated Water.

African Wildlife Foundation, Washington D.C.
1970-1980
Head of Research and Management in Africa office.

Responsible for conservation projects throughout sub-Saharan Africa, started and directed the Galana Game Ranch Research Project.

UK ODM/Kenya Government
1966-1970
Game Department Veterinary Officer.

Responsible for game capture, control of the export trade and wildlife/livestock disease problems.

Professional Societies:

1989-1992	Australian Society of Animal Production.
1962 to date	Royal College of Veterinary Surgeons, UK (elected Fellow in 1987).
1985-1989	Society for Veterinary Epidemiology and Preventative Medicine.
1985-1988	National Sheep Association, UK.

	1986-1988 Sheep Veterinary Society, UK.
	1975-1983 Animal Production Society of Kenya.
	1966-1983 Kenya Veterinary Association
Education:	Ph.D., M.A., Vet.M.B., F.R.C.V.S. **Cambridge University** England, 1956-1966
Languages:	English -native German -conversational Spanish -fair
Citizenship:	Australian and British
Country of Residency:	Germany
Publications:	Thirty four published in a thirteen different international journals and a number of books; list on application.

UNIVERSIDADE FEDERAL DE UBERLÂNDIA
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38.400 - UBERLÂNDIA - MG

Uberlândia, 16 Maio de 1994

Appendix D
Partner Confirmation Letters

Ilmo. Sr.
Dr. Miguel Ayarza
DD. Coordenador do projeto "Produção Animal em Sistemas Agropastoris" - CIAT

Prezado Senhor,

O Departamento de Produção Animal - DEPRA, teve vários conselheiros interessados no projeto supra mencionado, datado de 27 de Março de 1994, MA 005/94 e aceitou participar ativamente das ações propostas pelo projeto, colocando seus laboratórios e a Fazenda Experimental do Glória à disposição, bem como a equipe de professores, que por ventura enganjarem nos sub projetos a serem discutidos.
Além disso a Fundação de Desenvolvimento Agropecüario, ligada aos cursos de ciências agrárias desta Universidade, por meio do seu Diretor Executivo manifestou o apoio não só ao Departamento, mas também à implantação dos projetos.
Na certeza de estarmos contribuindo para a melhoria da ciência na produção animal, subscrevemo-nos, colocando-nos ao seu inteiro dispor.

Cordialmente,

PROF. MARCOS DIAS MOREIRA
Chefe Depto. Produção Animal

PROF. ADRIANO PUBTOUSCHEG
Diretor Executivo - FUNDAP

Fachbereich Agrarwissenschaften

der Georg-August-Universität

– Der Dekan –

Dr. Raul R. Vera
Director
Savannahs Program
CIAT
Apdo. aereo 6713
CALI /Columbia

Fax: 0057-23-647243

21.07.1994

SUSTAINABLE ANIMAL PRODUCTION FOR THE AGROPASTORAL SYSTEMS OF THE BRAZILIAN CERRADOS

Dear Dr. Vera,

I am writing to confirm that this project is considered a high priority and the Faculty, through the Tropical Animal Husbandry and Breeding Group of the Institute of Animal Breeding and Genetics, will provide the support necessary to fulfil its obligations as described in the proposal.

Yours sincerely

Prof. Dr. Paul L.G. Vlek

Der Dekan
FB Agrarwissenschaften
ehem. Landwirtsch. Fakultät
Universität Göttingen

22 JUL 1994

Anschrift: Am Vogelsang 6, 37075 Göttingen
Telefon: 0551/39-5532, -5530, -5531
Telefax: 0551/396034
Telex: 96703 unigoe

CIAT has in-house facilities for the production of high-quality training materials and video programs for scientific and extension agricultural activities.

This proposal was produced and published, using CIAT's computer layout and graphic composition facilities and outside low-cost copying services.