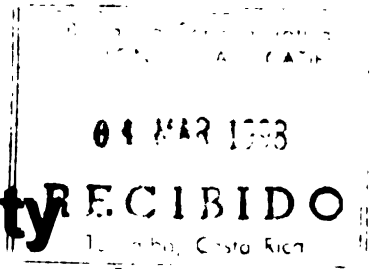


From Strategy to Reality



The Path to Institutional Excellence in Harsh Times

By ✓
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**CATIE's Presentation
at the International Centers Week
Washington, D.C.**

October 25th, 1997



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Our Mission

To improve the well-being of mankind

**through
research and higher education**

**in agricultural and related sciences for
development, conservation and sustainable
use of natural resources**

in the American tropics



Looking back: Planning and re-engineering

■ Planning Process in 1992-

- Participation of Stakeholders from the onset
- Dynamic vs. static planning : Bi-annual updates
- Planning levels: long, mid-term, short-term
- Assessment mechanisms for follow up

■ Re-engineering process 1993-

Agenda for a Critical decade. Strategic Plan 1993-2003

- Prepared in 1993, revised in 1995
- Under revision in 1997

Institutional Development Plan

- Prepared in 1995/1996

Mid-term plans of Programs

- Prepared in 1994 and 1995
- Bi-annual updates

Workplanning

- Bi-annual

CATIE's Gender Policy

- Prepared in 1996



Looking back: Funding

■ Strategies for core-project support

- Donors as partners
- Endowment fund
- Foundation

■ Strategies for income generation

- Productive activities with private-sector efficiency
- Definition of institutional "market niches"



Looking back: Partners and allies

- **Co-operation with strategic partners**
 - The common agenda was concerted and agreed upon
 - Shared responsibilities and benefits

- **Strategies for Regional Expansion**
 - Covering the key countries in the mandate area

- **Differentiated Strategies for different countries**
 - Conditions and needs
 - Resources, capabilities for co-operation



Strategic positioning: Reading the trends

■ Interpreting political trends

- **Less emphasis in Central America**
- **Emphasis in poverty and environment**
- **New mechanisms for co-operation**

■ Interpreting policies for development aid

- **Emphasis in the triangle:**
 - **Poverty alleviation**
 - **Environmental protection**
 - **Food production**
- **Donor co-operation and integration**
- **Gender policy**



Strategic positioning: Defining priorities

- **Interpreting stakeholders' priorities**
 - **Emphasis in training**
 - **Emphasis in information**
 - **New tasks and opportunities (valuation etc.)**

- **Adjusting CATIE to prepare for new situations**

- **Prioritise:**
 - **Education - Research**
 - **Research: Focusing and working in partnerships**
 - **Outreach: Work through partnerships and use modern communication technologies**



The Outcome: Education

- Demand: 4x
- Number of graduate students: up 40%
- Higher standards for entrance
- New product for new demand: Ph.D. programme
- New alliances: USA, Canada, Germany, Denmark, Sweden etc.
- Persons trained in short courses: 5x
- Donor reaction: support doubled

M.Sc.:

In four areas:

- Sustainable Agriculture
- Agroforestry
- Forestry and the Management of Biodiversity
- Environmental Economics and Sociology

Oldest program of its kind in Latin America

More than 1000 graduates

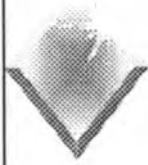
Ph.D.

New program, started in 1996

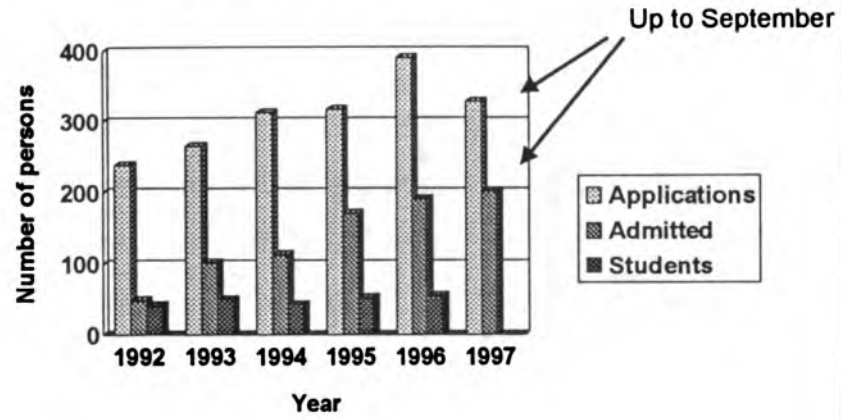
In partnership with universities in the USA and Europe

In two areas:

- Tropical Agroforestry
- Tropical Forestry

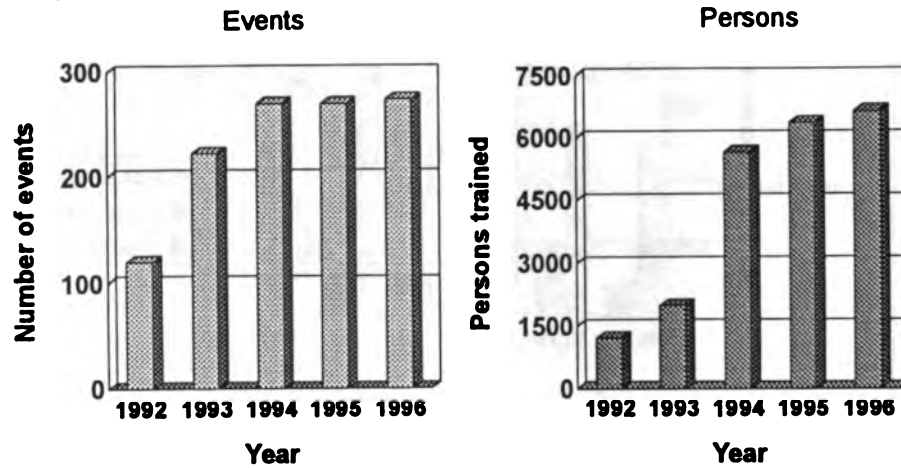


Students in the postgraduate school





Training: Events and persons trained



In 1996, 274 training events were held:

20% at CATIE's headquarters in Turrialba, Costa Rica

76% in member countries

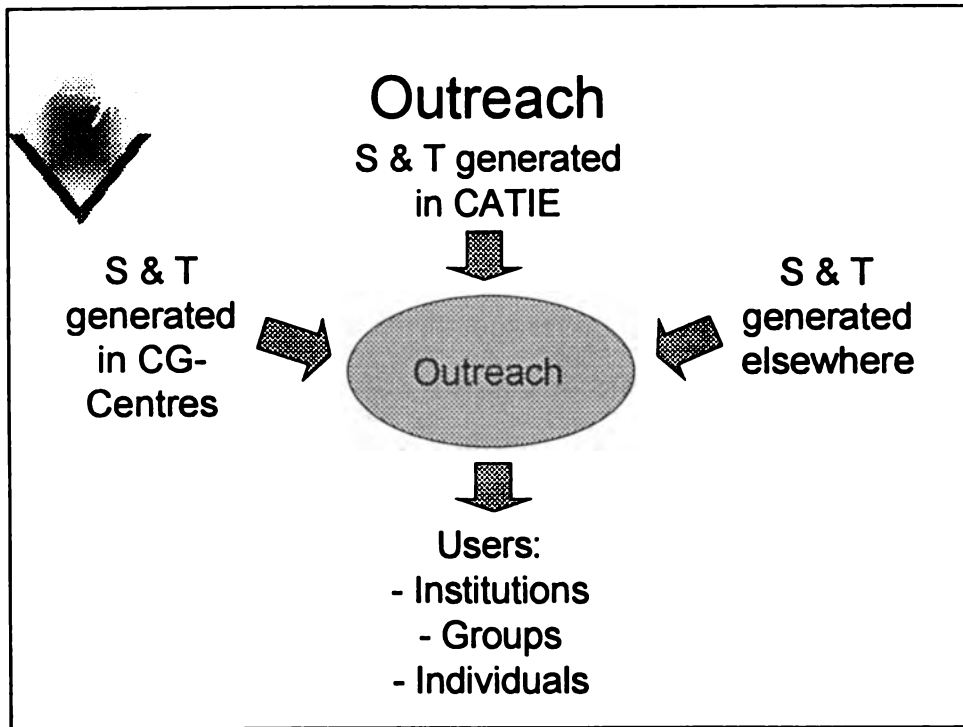
4% in other countries

On the average, 24 persons/event



The Outcome: Outreach

- **Emphasis in electronic information systems and connectivity**
- **World-wide coverage of information services**
- **New partners: IPGRI, EU etc.**
- **Alliances at the national level**
- **Emphasis on networks**
- **Donor support: currently app. 50% of project budget, including core-budget support**



S & T = Science and Technology



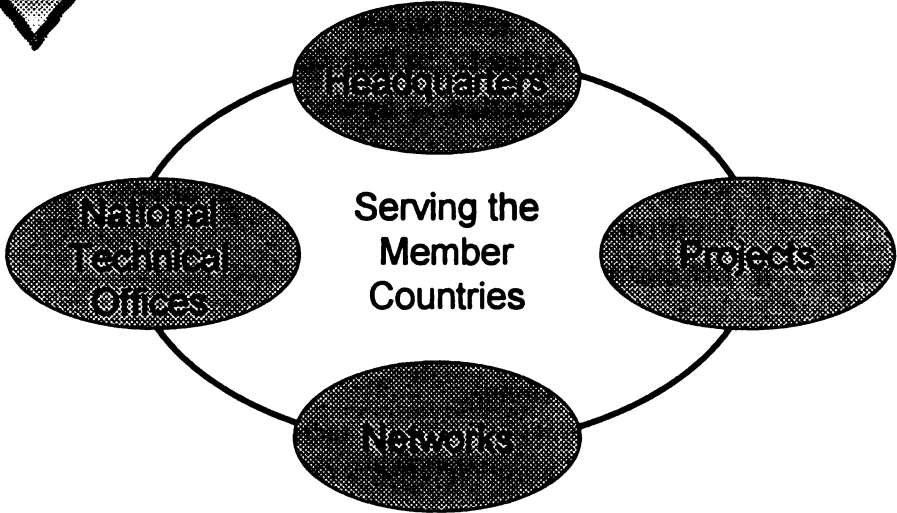
Outreach: Example The Madeleña project

- **Intensive research on fast growing forest trees in Central America (> 14 000 sample plots)**
- **Scientific information system (MIRA) for data collection and management**
- **Networking research: international allies, national institutions**
- **Efficient extension network:**
 - **6 countries**
 - **31 network organizations**
 - **650+ extensionists**
 - **20 000 farmers directly contacted**
 - **80 000 neighboring farmers reached through multiplier effect**

Reference:

Cannon, P.G. and Galloway G..E. 1995. Fostering Regional Unity. The Madeleña Project of Central America. *Journal of Forestry* Vol.. 93, No. 10: 32-35.

Dynamic Linkages with Partners and Allies





The Outcome: Research

- **Focusing on strengths**
- **Consolidation of Interdisciplinary research teams**
- **Refereed publications: 4x**
- **New partners in research:**
 - **CIFOR, CIRAD, ORSTOM, NRI and other research institutions**
 - **Universities in Brazil, Finland, Denmark, Germany, Sweden, UK, USA etc**

The mid-term plan "Research lines" prepared in 1996
Definition of research priorities
Formation of interdisciplinary research groups



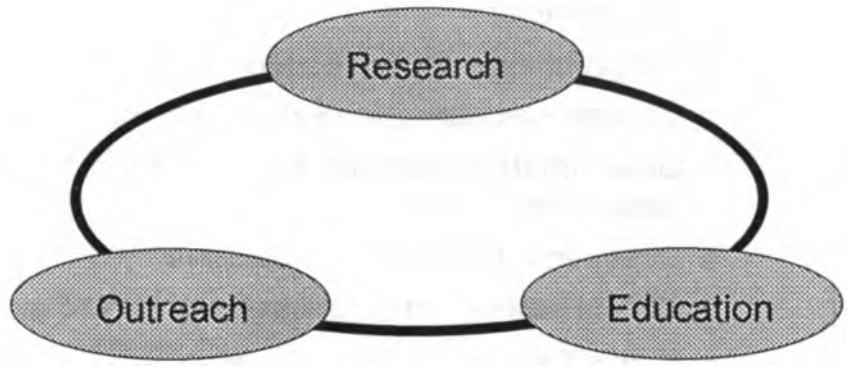
The Outcome: Integration

- **Integration of Research and Education**
 - **Scientists, professors, and students make up research teams**
 - **Scientific and academic excellence**
- **R&D feeding Outreach**
 - **Linking the production of information closely with its dissemination**
 - **Regional impact, institutional relevance**



Our Strength in the Future

Is in the Integration of Three Major Functions



The Lessons Learned



- **Constant sensing of future trends and demands**
- **Planning processes at all levels**
- **Continuous monitoring, evaluation and impact assessment**
- **Frequent external evaluations**
- **Constant feedback from stakeholders**
- **Differentiated strategies for services and income generation**
- **Cost/benefit sharing with partners**
- **Accountability, transparency**
- **High efficiency and effectiveness**



Research at CATIE: Strategy

- **Focus on problem solving research through interdisciplinary research projects**
 - **Definition of five priority research lines**
- **Regional coverage through networking**
- **Collaboration with international research institutions and universities**
- **Collaboration with NARS and universities in the region**
- **Contribution to the strengthening of R&D in member countries**



Research at CATIE: Resources

- **Qualified personnel**
 - 20 Full time researchers - professors with Ph.D. degrees
 - 25 Researchers with Ph.D. degrees
 - 60 Researchers with M.Sc. or Lic. Sc. degrees
- **Approximately 55 M.Sc. and 10 Ph.D. students per year**
- **Laboratories**
 - Biotechnology, GIS etc.
- **Experimental areas, data bases, information systems**
- **Collections**
 - *Coffea, Musa, Theobroma* etc.



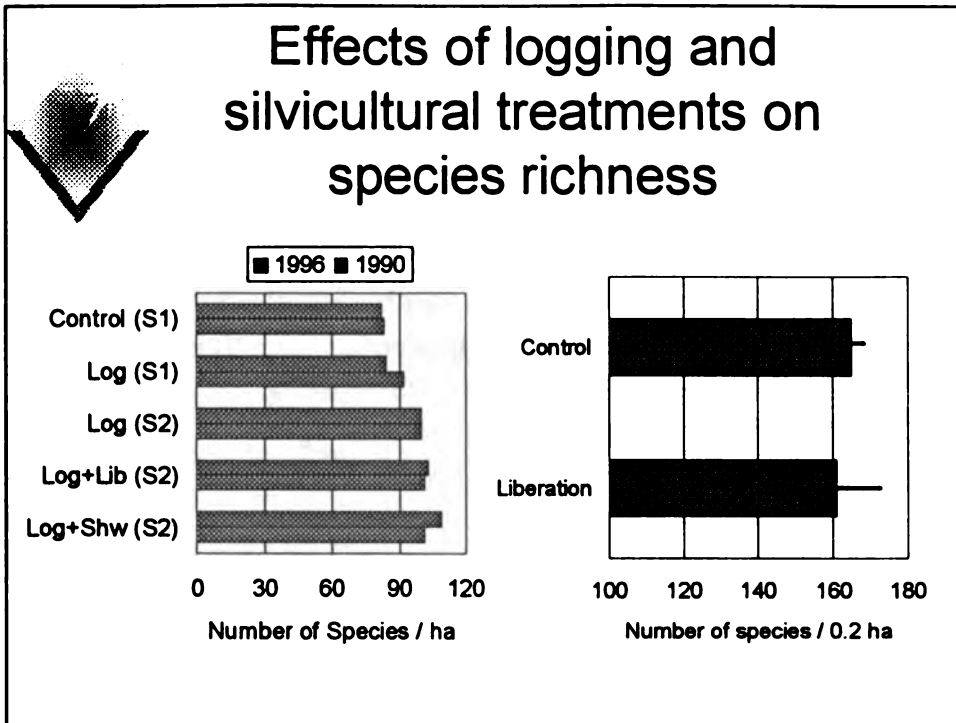
Research at CATIE: Partners

- **Co-operation with national institutions and universities in member countries**
- **Regional networks**
 - REDCA, PROMECAFE, IPM, REMERFI, Agroforestry, Plantations
- **Bilateral agreements with CGIAR centers**
 - CIAT, CIFOR, ICRAF, IPGRI, INIBAP/IPGRI, ISNAR
- **Bilateral agreements with universities and research centers**
- **Budget**
 - Core: US\$ 2 million
 - Projects: US\$ 4 million



Research at CATIE: Some examples

- **Somatic embryogenesis of *Coffea arabica* as a tool of improvement**
- **Biocontrol of Black Sigatoka in bananas**
- **Long-term ecological and economic benefits from agroforestry systems with perennial crops and timber trees**
- **Diversified management of natural forests in the tropics**



Treatments:

Control = No treatments

Log = Logging

Lib = Liberation

Shw = Shelterwood

Sites:

S1 = Corinto, Costa Rica

S2 = Tirimbina, Costa Rica



Future trends in research

- **Emphasis on quality**
- **Problem-oriented research with verifiable impact**
- **Strengthening of partnerships with the international scientific community**
- **Networking with allies in the region**
- **Utilization of new technologies for research and development**
- **Full integration of research and higher education**
- **Research linked to outreach**



Somatic embryogenesis of *Coffea arabica* as a tool of improvement

- **Coffee is one of the most important crops in Central America, Jamaica, Colombia, and Brazil**
- **The varieties cultivated originate from a limited genetic base**
- **Low adaptability and high susceptibility to principal pests**
- **Duration of the conventional selection process: 20 to 35 years**



Somatic embryogenesis of *Coffea arabica*: Objective

- **Produce and disseminate high quality genetic material for small coffee growers in CATIE's member countries**
- **Increase the adaptability and productivity of selected varieties**
- **Better resistance to the main pests and diseases of the region**
- **Maintain or improve coffee quality**

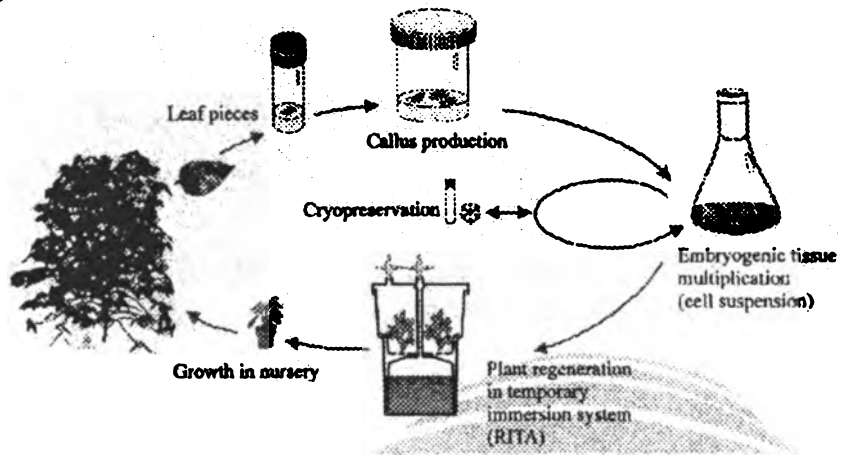


Somatic embryogenesis of *Coffea arabica*: Strategy

- **Basic methodological research at CATIE's headquarters**
- **Applied research with national partners**
- **Pilot scale production in a well-distributed regional network**
- **Joint program since 1992 (PROMECAFE, CATIE and French Co-operation)**



Somatic embryogenesis of *Coffea arabica*: Methods





Somatic embryogenesis of *Coffea arabica*: Advances

- All the selected genotypes tested (17) have been multiplied at a large scale with this process
- Development of a new bio-reactor (RITA)
 - Semi-automatization of the somatic embryogenesis process
 - From cell to plant in liquid medium and in the same bio-reactor
- High productivity
 - 6,000 plants ready for ex-vitro hardening/year/bio-reactor
- Converting somatic embryos to plantlets directly in the greenhouse (for the first time)

Presently, *in vitro* micropropagation techniques offer the only method for rapid propagation of the hybrid material. For this purpose, a high frequency somatic embryogenesis method (RITA) was developed.

Fifteen *Coffea arabica* F1 hybrids and the two parents of the variety "Nemaya" (*Coffea canephora*) were introduced in the laboratory in 1996.

The objectives of this work are the technical and economic evaluation of the *in vitro* process, the scale-up of production and field evaluation of the plants (agronomic performances, check-up on plant conformity through research of somaclonal variations) in four countries of the region (Honduras, El Salvador, Guatemala, Costa Rica).

The process will be transferred to national institutions in the member countries in the year 2000. Using this micropropagation process, a commercial diffusion of the improved varieties is expected around 2003.



Somatic embryogenesis of *Coffea arabica*: Results

- Reduction of the selection process from 25-35 to 5-10 years, working at the F₁ level
- Different varieties have been put forward
- It is possible to automate somatic embryogenesis by using liquid media (RITA technology)
- Mass production of plants at a low cost is possible

References:

Bertrand B., Aguilar G., Santacreo R., Anthony F. & Etienne H. (1997). Comparación de híbridos F1 con variedades de *Coffea arabica*. XVIII Simposio Latinoamericano de caficultura, 16-18 Setiembre 1997, San José, PROMECAFE ed., pp. 245-251.

Etienne H., Solano W., Pereira A., Barry-Etienne D., Bertrand B., Anthony F., Côte F. & Berthouly M. (1997). Utilización de la embriogénesis somática en medio líquido para la propagación masal de los híbridos F1 de *Coffea arabica*. XVIII Simposio Latinoamericano de caficultura, 16-18 Setiembre 1997, San José, PROMECAFE ed., pp. 253-261.



Black Sigatoka disease in bananas

- **Central America: 100 thousand hectares of banana plantations**
- **Main disease is the Black Sigatoka - caused by the fungus *Mycosphaerella fijiensis*. Management of the pathogen is based on the use of fungicides**
- **In Central America, approximately US\$100 million is spent annually for fungicides in bananas**



Black Sigatoka disease in bananas

- **The use of fungicides causes human health problems and environmental contamination**

- **Result of frequent applications of fungicides:**
 - **Strong selection process by the pathogen with the consequent development of resistance**



Biocontrol of Black Sigatoka in bananas: Objectives

- Reduce fungicide use in banana cultivation
- Reduce adverse impacts on human health and on the environment
- Look for antagonistic microorganisms to *Mycosphaerella fijiensis*
- Test their efficiency under screenhouse and field conditions
- Determine the effect of substrates on growth in the phyllosphere of the microorganism

Massive applications of bacteria could have unpredictable environmental effects. However, extracts of these bacteria applied to foliage are an alternative which favor antagonism, while decreasing their use frequency and potential risk. Thus, research is conducted to determine the effect of substrates on growth in the phyllosphere of chitinolytic and gluconolytic microorganisms.

Bacterial isolates were obtained from the cultivar "Grand nane" and tested for chitinolytic and gluconolytic production ability and compatibility with fungicides.

The efficacy of the selected microorganisms and extracts was tested in screenhouse and field conditions under high inoculum pressure of the fungus.

Bacteria present in the rhizosphere was selected to be applied to the plant root in order to look for effects on plant growth.

The laboratory and screenhouse research was conducted at CATIE and field tests were conducted at the Standard Fruit Company and The Humid Tropical Agriculture School (EARTH) in Costa Rica.



Biocontrol of Black Sigatoka in bananas: Results

- ***Bacillus subtilis* and *Serratia marcescens* were as effective as fungicides to control *Mycosphaerella fijiensis* under greenhouse conditions**
- **The selected microorganisms, *Bacillus subtilis*, *Serratia marcescens*, *Pseudomonas cepacia*, and *Pseudomonas fluorescens* showed high capacity for chitinase and glucanase production**

References:

González, R., Bustamante, E., and Shannon, P.J. 1995. Biological control of black sigatoka diseases (*Mycosphaerella fijiensis*). *Phytopathology* 85:1563.

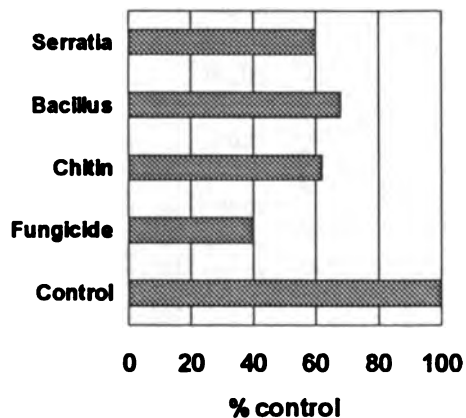
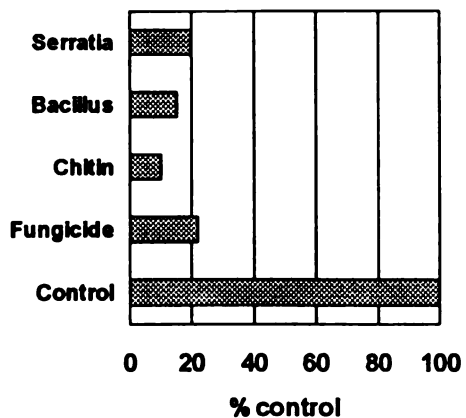
González, R., Bustamante, E., Shannon, P., Okumoto, S., and Leandro, G. 1996. Selección de microorganismos quitinolíticos en el control de sigatoka negra (*Mycosphaerella fijiensis*) en banano. *Manejo Integrado de Plagas (C.R.)* no. 40:6-11.



Black Sigatoka: Biocontrol

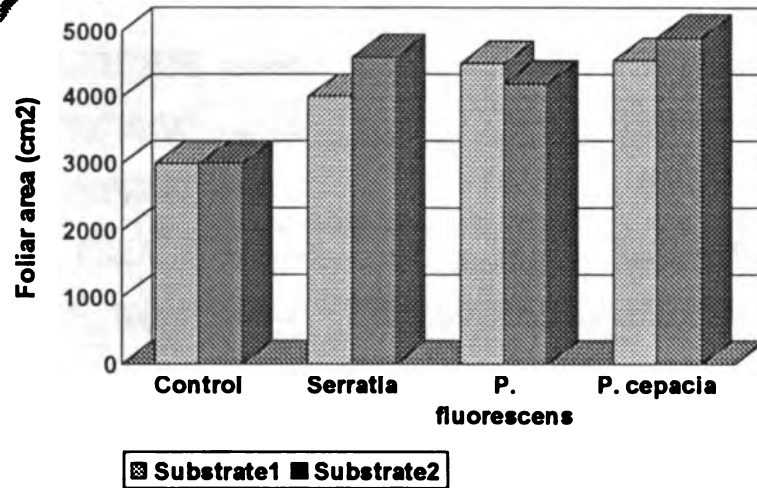
Screenhouse

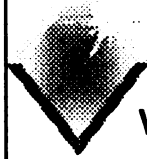
Field





The use of substrates: Increased foliar area





Long-term ecological and economic benefits from agroforestry systems with perennial crops and timber trees

- **In tropical America, approximately 1.5 million families depend on the income from coffee growing**
- **Farms with low capital input are vulnerable to fluctuations in coffee prices**
- **In the early 1970's, intensive coffee monocultures with high agrochemical inputs were promoted, leading to increased vulnerability**
- **The combination of perennial crops with timber trees offers a feasible solution**



Agroforestry systems with perennial crops: Objectives

- **Increase ecological and economic sustainability in small and medium-sized farms**
- **Increase productivity through improved production systems, and reduce vulnerability to changes in commodity prices**
- **Reduce adverse environmental impacts**
- **Evaluate the productivity of traditional and modern agroforestry systems and the ecological interactions between their components**

The research was initially focused on the evaluation of traditional systems on private farms (case studies) carried out by CATIE staff and students. Most of the emphasis was on evaluating productivity (tree and crop) and biophysical variables, particularly nutrient cycling and other effects on soils (e.g. erosion reduction).

A second phase involved formal experiments both on-farm and on-station, particularly species trials of both native (traditional) and exotic shade trees. The emphasis shifted towards a more applied approach, with less emphasis on ecological interactions (light, water, nutrients), but increased emphasis was given to financial analyses, e.g. sensitivity analyses.

The third phase is aimed at generalizing the results of the site-specific research.



Agroforestry systems with perennial crops: Strategy

- **Development of concepts and models of basic processes and their interactions**
 - In collaboration with universities and international research centers
- **Collaboration with a network**
 - NARS, PROMECAFE etc.
 - Larger number of trial sites where standardized methodologies and protocols are used
- **Complementary studies of traditional practices with national and regional sampling**

References:

Beer, J.W., Bonneman, A., Chavez, W., Fassbender, H.W., Imbach, A.C. and Martel, I. 1990. Modelling agroforestry systems of cocoa with *Cordia alliodora* and *Erythrina poeppigiana* in Costa Rica. V. Productivity indices, organic matter models and sustainability over ten years. *Agroforestry Systems* 12: 229-249.

Beer, J., Muschler, R., Kass, D. and Somarriba, E. 1997. Shade management in coffee and cocoa plantations. *Agroforestry Systems* (In press).

Galloway, G. and Beer, J. 1997. Oportunidades para fomentar la silvicultura en cafetales en America Central. CATIE. Technical Series. Technical Report No. 285. 168 p.

Somarriba, E. 1992. Timber harvest, damage to crop plants and yield reduction in two Costa Rican coffee plantations with *Cordia alliodora* shade trees. *Agroforestry Systems* 18:69-82.



Agroforestry systems with perennial crops: Results

- **Increased sustainability and diversification in production**
 - High returns to labor and capital in *Coffea arabica* with *Cordia alliodora*
 - Timber trees in coffee plantations: up to 40% of the present net value
 - Coffee bean size increased with shading
- **Positive impact on the environment**
 - Increased inputs of organic material and carbon to the soil
 - Low levels of nutrient leaching
- **Change of policies of national coffee institutes from seeking maximum productivity to seeking sustainable productivity**

Timber shade for coffee (*Coffea* - *Cordia* - *Erythrina*):

Increased farmer income

Benefit/cost ratio increased by 20% and return to labor by 25% when *Cordia alliodora* was introduced into traditional coffee plantations under *Erythrina poeppigiana*

Nitrogen fixation - 60 kg ha⁻¹ yr⁻¹

Carbon fixation: 2 - 5 t C ha⁻¹ yr⁻¹

High coffee production: 2 tons of beans ha⁻¹ yr⁻¹

Wood production: 10-15 m³ ha⁻¹ yr⁻¹ of which 70% was commercial timber

Timber shade for cocoa:

Increased farmer income

Tabebuia rosea and *Cordia alliodora* produce 9-18 m³ ha⁻¹ yr⁻¹ without affecting cocoa production

Carbon fixation: 5 - 7 t C ha⁻¹ yr⁻¹



Diversified management of natural forests in the American tropics

- **Present area in the American tropics: 6 million square kilometers**
- **High deforestation rates: 0.7% for Tropical Americas, 1.6% for Central America**
- **Natural forest management for production is currently high on the agendas of governments, NGOs, scientific organizations and forest owners world-wide**
- **In rural areas, millions of people could benefit from sustainable, diversified management of natural forests**
- **Limiting factors: information on management, no long-term experimentation and monitoring**



Diversified management of natural forests: Objectives

- **To contribute to the development of viable methods for diversified management of natural broad-leaved tropical moist forests**
- **These methods should be:**
 - **socially acceptable**
 - **ecologically sustainable**
 - **economically attractive, and**
 - **technically viable**
- **Diversified management refers to the sustainable production of both timber and non-timber products**



Diversified management of natural forests: Strategy

- **Long-term research is planned, and will be centered around a series of Key Sites**
 - Sites in priority biogeographic and political regions in which forest areas are managed by the forest owner (private or community)
 - Costa Rica (6), Nicaragua (2), and Guatemala (2)
 - Scientific information system for standardized data collection and processing
- **Partnership with CIFOR**
 - Additional Key Sites for secondary forests in Peru, Nicaragua and Brazil
- **Transfer process and feedback through networking**



Diversified management of natural forests: Results

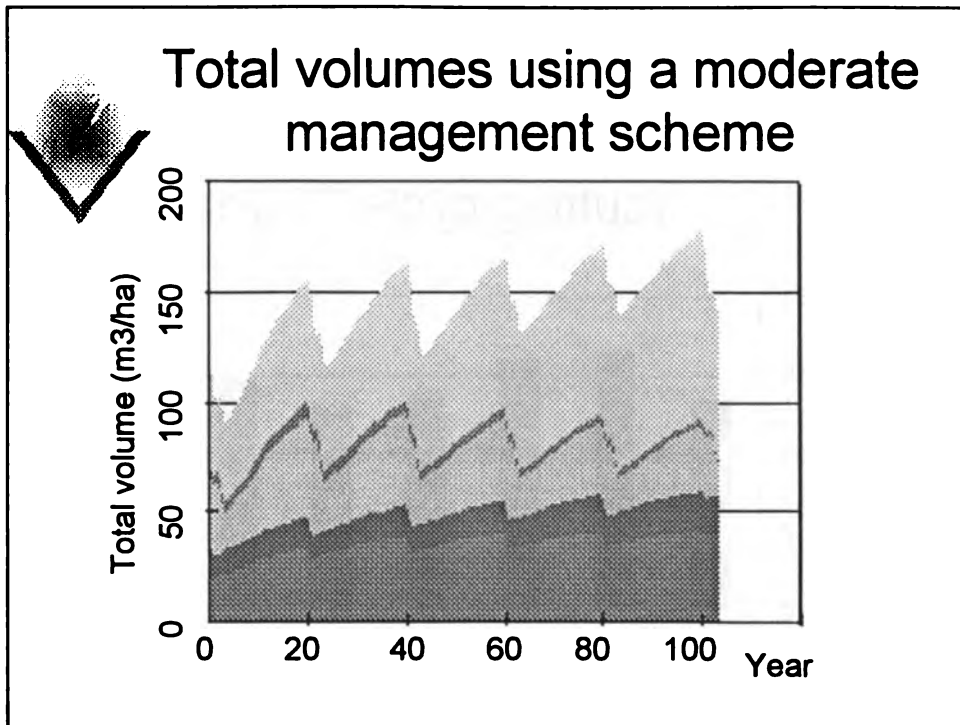
- **Long-term sustainability in terms of volume**
 - Sustainable extraction: 20-30 m³ ha⁻¹
 - Increment in the total volume and the volume of potentially commercial species
- **Long-term sustainability in the composition and distribution of species**
 - Logging does not decrease the number of species - silvicultural treatments may
- **Economic feasibility depends on cost and price structure, market situation, and policy environment**
- **Research results have been used to establish guides for policies and practices of forest management**

References:

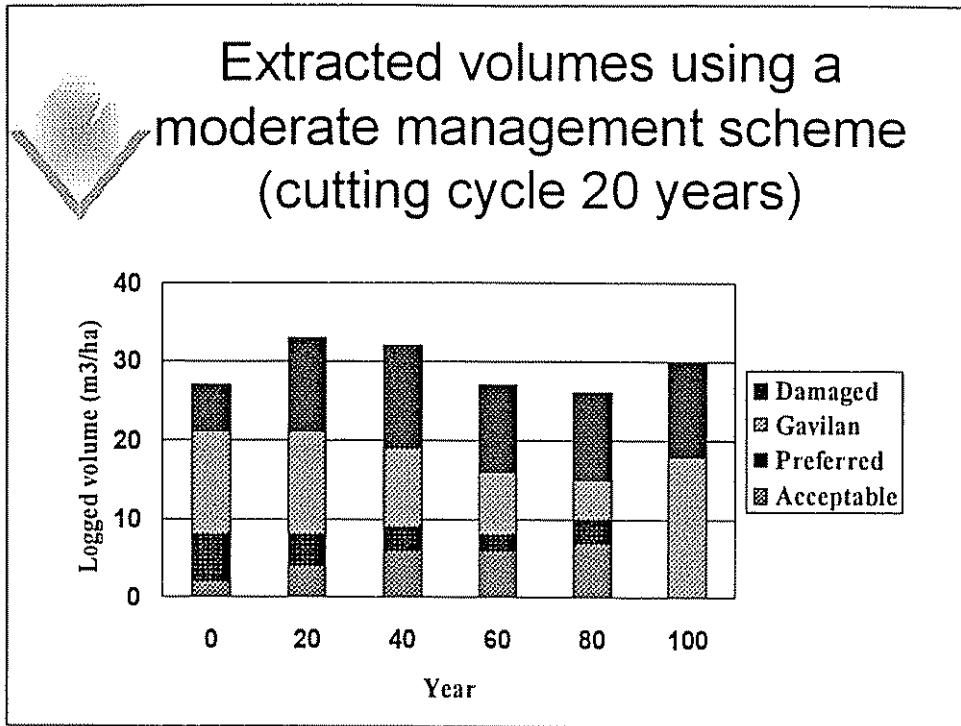
Camacho, M. and Finegan, B. 1997. Effects of timber harvesting and silvicultural treatment on a tropical rainforest of northeastern Costa Rica: diameter growth, with emphasis on the commercial stand. Diversified Forest Management Collection , Technical Report No. 295, CATIE (in Spanish).

Finegan, B. 1992. The management potential of neotropical secondary lowland rain forest. *Forest Ecology and Management* 47: 295-321.

Herrera, B. and Finegan, B. 1997. Substrate conditions, foliar nutrients and the distributions of two canopy tree species in a Costa Rican secondary rain forest. *Plant and Soil* 191: 259-267.



Colours (from top down):
 Light blue: Gavilan = *Pentaclethra macroloba*
 Velvet: Palms
 Green: Non-commercial species
 Blue: Preferred species
 Orange: Acceptable species



Gavilan = *Pentaclethra macroloba*