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UNITED STATES INTERNATIONAL DEVELOPMENT COOPERATION AGENCY
AGENCY FOR INTERNATIONAL DEVELOPMENT
Washington, D. C. 20523

ROCAP

PROJECT PAPER

INTEGRATED PEST MANAGEMENT

AID/LAC/P-178

Project Number:596-0110

UNCLASSIFIED

AGENCY FOR INTERNATIONAL DEVELOPMENT

PROJECT DATA SHEET

1. TRANSACTION CODE: A (A = Add, C = Change, D = Delete) — Amendment Number

DOCUMENT CODE: 3

2. COUNTRY/ENTITY: ROCAP

3. PROJECT NUMBER: 596-0110

4. BUREAU/OFFICE: Latin America and the Caribbean — 05

5. PROJECT TITLE (maximum 40 characters): Integrated Pest Management

6. PROJECT ASSISTANCE COMPLETION DATE (PACD): MM 05 DD 31 YY 89

7. ESTIMATED DATE OF OBLIGATION (Under 'B.' below, enter 1, 2, 3, or 4)

A. Initial FY 84 B. Quarter 3 C. Final FY 88

8. COSTS ($000 OR EQUIVALENT $1 =)

A. FUNDING SOURCE	FIRST FY 84 B. FX	C. L/C	D. Total	LIFE OF PROJECT E. FX	F. L/C	G. Total
AID Appropriated Total						
(Grant)	(600)	(-)	(600)	(4,250)	(2,500)	(6,750)
(Loan)	( )	( )	( )	( )	( )	( )
Other U.S. 1.						
Other U.S. 2.						
Host Country	-	-	-	520	230	750
Other Donor(s)						
TOTALS	600	-	600	4,770	2,730	7,500

9. SCHEDULE OF AID FUNDING ($000)

A. APPROPRIATION	B. PRIMARY PURPOSE CODE	C. PRIMARY TECH. CODE 1. Grant	2. Loan	D. OBLIGATIONS TO DATE 1. Grant	2. Loan	E. AMOUNT APPROVED THIS ACTION 1. Grant	2. Loan	F. LIFE OF PROJECT 1. Grant	2. Loan
(1) FN	141	079		-		600	-	6,750	-
(2)									
(3)									
(4)									
TOTALS				-		600	-	6,750	-

10. SECONDARY TECHNICAL CODES (maximum 6 codes of 3 positions each): 549 029 978

11. SECONDARY PURPOSE CODE: 211

12. SPECIAL CONCERNS CODES (maximum 7 codes of 4 positions each)

A. Code	BR	R/AG	ENV	TNG			
B. Amount							

13. PROJECT PURPOSE (maximum 480 characters)

To strengthen national and regional capabilities for development and implementation of effective integrated pest management in Central America and Panama.

14. SCHEDULED EVALUATIONS

Interim MM 01 YY 86 MM 01 YY 88 Final MM 06 YY 89

15. SOURCE/ORIGIN OF GOODS AND SERVICES: [X] 000 [ ] 941 [ ] Local [X] Other (Specify)

16. AMENDMENTS/NATURE OF CHANGE PROPOSED (This is page 1 of a ____ page PP Amendment.)

17. APPROVED BY

Signature: John R. Eyre

Title: Acting Director ROCAP

Date Signed: MM 04 DD 10 YY 84

18. DATE DOCUMENT RECEIVED IN AID/W, OR FOR AID/W DOCUMENTS, DATE OF DISTRIBUTION: MM DD YY

AID 1330-4 (8-79)

UNITED STATES INTERNATIONAL DEVELOPMENT COOPERATION AGENCY
AGENCY FOR INTERNATIONAL DEVELOPMENT
WASHINGTON, D.C. 20523

PROJECT AUTHORIZATION

Name of Entity : Tropical Center for Agricultural Research and Training (CATIE)

Name of Project : Integrated Pest Management

Number of Project : 596-0110

1. Pursuant to Section 103 of the Foreign Assistance Act of 1961, as amended, I hereby authorize the Integrated Pest Management Project with the Tropical Center for Agricultural Research and Training ("CATIE"), involving planned obligations of not to exceed Six Million Seven Hundred Fifty Thousand United States Dollars ($6,750,000) in grant funds ("Grant") over a five-year period from the date of authorization, subject to the availability of funds in accordance with the A.I.D. OYB/allotment process, to help in financing foreign exchange and local currency costs for the Project.

2. The project ("Project") consists of assistance to CATIE to strengthen the capacities of national and regional organizations in Central America and Panama to develop and implement effective integrated pest management practices through a) research, b) training, and c) advisory services.

3. The Project Agreement, which may be negotiated and executed by the officer to whom such authority is delegated in accordance with A.I.D. regulations and Delegations of Authority, shall be subject to the following essential terms and covenants and major conditions, together with such other terms and conditions as A.I.D. may deem appropriate.

a. Source and Origin of Commodities, Nationality of Services

Commodities financed by A.I.D. under the Grant shall have their source and origin in countries which are members of the Central American Common Market ("CACM"), Panama, or the United States, except as A.I.D. may otherwise agree in writing. Except for ocean shipping, the suppliers of commodities or services shall have countries which are members of CACM, Panama or the United States as their place of nationality, except as A.I.D. may otherwise agree in writing. Ocean shipping financed by A.I.D. under the Grant shall be financed only on flag vessels of the United States, except as A.I.D. may otherwise agree in writing.

b. Conditions Precedent to Disbursement

(1) Prior to the disbursement, or the issuance of any commitment documents under the Project Agreement to finance activities under the Grant, other than for hiring long-term personnel, CATIE shall, except as A.I.D. may otherwise agree in writing, furnish, in form and substance satisfactory to A.I.D., a detailed time-phased plan setting forth all activities to be completed during the first year of the project.

(2) Prior to the disbursement, or the issuance of any commitment documents under the Project Agreement to finance activities in any one of the participating countries, CATIE shall, except as A.I.D. may otherwise agree in writing, furnish, in form and substance satisfactory to A.I.D., an executed letter of agreement with the primary agriculture institution of that particular eligible participating country. The letters of agreement shall, inter alia, contain provisions which outline the roles of CATIE and the national institution; establish working relationships between CATIE, country coordinators and national institutions; and identify national inputs to the project.

c. Covenants

CATIE shall covenant that, except as A.I.D. may otherwise agree in writing:

(1) All fees and services provided under the Project shall be used to finance costs related to the Project;

(2) CATIE shall provide appropriate housing for the long-term advisors at CATIE funded under the Project Agreement;

(3) CATIE will coordinate Project activities with USAID missions in each country which participates in this project;

(4) Prior to undertaking Project activities for each year after the first year of the Project, CATIE will furnish, in form and substance satisfactory to A.I.D., a consolidated workplan and budget for activities for that year.

Marshall D. Brown 6/8/

Marshall D. Brown
Acting Assistant Administrator
Bureau for Latin America and
the Caribbean

Clearances:
GC/LAC:RBMeighan
LAC/DR:DJohnson
LAC/DP:JOleson
LAC/CEN:RQueener

INTEGRATED PEST MANAGEMENT

596-0110

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ACRONYM LIST

AGRINTER - Interamerican Agricultural Science Information System

CATIE - Tropical Agricultural Research and Training Center

CENTA - National Agricultural Technical Center

CGIAR - Consultative Group in International Agricultural Research

CIAT - International Center for Tropical Agriculture

CIDIA - Interamerican Center for Documentation and Information in Agriculture

CIMMYT - International Center for Improvement of Maize and Wheat, Mexico

DDA - Directorate of Agricultural Defense, El Salvador

DIGESA - Directorate General of Agricultural Services, Guatemala

EAP - Panamerican School of Agriculture, El Zamorano, Honduras

GTZ - German Agency for Technical Cooperation

ICTA - Institute for Agricultural Science and Technology, Guatemala

IDIAP - Panamanian Institute for Agricultural Research

IICA - Interamerican Institute for Agricultural Cooperation

IRRI - International Rice Research Institute

MAG - Ministry of Agriculture and Livestock, Costa Rica

MIDA - Ministry of Agricultural Development, Panama

OIRSA - Regional International Agricultural Quarantine Agency, El Salvador

PNIA - National Agricultural Research Program, Honduras

PPD - Plant Production Department, CATIE

UCR - University of Costa Rica

I. PROJECT SUMMARY

A. Recommendation

ROCAP recommends that a $6.75 million grant be authorized to implement the Regional Integrated Pest Management Project. ROCAP and the Center for Tropical Agricultural Research and Training (CATIE), located in Turrialba, Costa Rica, will sign a grant agreement to obligate funds. CATIE will implement the project over a five year period in collaboration with national institutions in Central America and Panama (CA/P).

B. Summary Description

1. Goal, Purpose and Beneficiaries

The goal of the project is to help increase agricultural productivity of Central America and Panama and enhance the health and living standards of rural families in the region.

The purpose of the project is to strengthen national and regional capabilities for development and implementation of effective integrated pest management (IPM) practices in Central America and Panama.

While the project is essentially institution building in nature, the ultimate beneficiaries of an improved regional capacity to implement sound IPM programs will be the small farmers of the region. (See Social Soundness Analysis, Annex I-I, for a description of this target group).

2. Background and Project Activities

Plant diseases, insects, nematodes, weeds, birds, rodents, and snails and slugs -- collectively "pests" -- are causing enormous losses to crops and harvest products in Central America and Panama, estimated at 25-40% of total potential production. A conservative estimate of the economically quantifiable impacts of these pests and pest control in the CA/P region is an annual cost of from $650 to $800 million. (See details in the Economic Analysis, Annex I-H).

For most small farmers, there are no organized methods of crop protection. Some simply tolerate pests or rely on natural forces to control them. Others may rely on pesticides, but few are able to diagnose pest problems accurately or apply the chemicals correctly and safely. Pesticides, when used, are frequently applied haphazardly, often involve unnecessary production expenditures, and present a hazard to human health and the environment. Use of pesticides on cotton, especially, has resulted in some serious health and environmental problems.

The rapidly expanding population in the region is increasing pressure on the agriculture sector to produce more. With the best lands already in production, however, increases must be achieved, in part, by improved productivity on existing lands.

Crop protection through integrated pest management provides a method for minimizing crop losses with the least possible cost to the farmer and disruption of the environment. Since the late 1960's, various attempts have been made to introduce IPM in selected areas of the region. While these efforts have generated useful information, they have been short-lived, limited in scope (mostly insect pests) and focused mostly on cotton and other non-food crops. Little effort was devoted to pest problems or control alternatives on basic grains and food crops. Consequently, although interest in IPM is high, it has not advanced significantly in the region.* Several interrelated obstacles to achieve widespread acceptance of IPM have been identified:

-- Insufficient personnel involved in the agriculture sector trained in IPM principles and practices.

-- Lack of information and procedures for correctly identifying pest problems and assessing their economic impact.

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*A recent example of the level of interest in IPM in Central America was the second annual congress sponsored by the Guatemalan Association for IPM, held in February 1984 in Guatemala. Approximately 300 persons from the public and private sectors throughout the region (including some from Mexico and Colombia) attended the week long session.

-- Lack of understanding and support for interdisciplinary IPM research projects and companion educational and demonstration programs.

-- Unavailability and/or inaccessibility of information related to the development and implementation of IPM.

-- Poor communication and cooperation among individuals and institutions in the region working in crop protection.

The proposed project is designed to address each of these constraints. The project will strengthen the technical capacity of the regional and national institutions with responsibility for crop protection through research which will adapt known technologies to small farmer cropping systems in CA/P, long and short-term training to build an interest in and transfer the technologies, and technical cooperation to satisfy immediate and continuing information needs. Three project components are planned to carry out these activities.

a. Research

The research component will build on the experiences of the ROCAP-financed Small Farm Production Systems project and emphasize the development of optional IPM schemes which fit CA/P farming systems. It includes the following interrelated activities:

-- Crop Loss Assessments to identify the most important pest problems of the selected crops, estimate the economic impact of these problems and establish priorities for on-farm research involving specific IPM practices.

-- Approaches and Methods in IPM to define the sequence and pattern of implementing IPM practices at the farm level, including the appropriate use of pesticides.

-- Socioeconomic Research to identify constraints to transfering IPM technologies in the region.

b. Training

This component will focus on both public and private sector individuals and will have several objectives: (1) increasing awareness on the potential contribution of IPM to increased productivity; (2) strengthening the technical knowledge of agricultural research and extension professionals, farmers, private sector groups (e.g., pesticide distributors) and public health officials on IPM methodologies; (3) developing a centralized regional source of technical knowledge at CATIE; and (4) responding to training needs of ongoing crop protection activities in the region. Master's level training at CATIE as well as several workshops and seminars throughout the region are planned and will receive financing under the project.

c. Technical Cooperation

Under this component, project personnel will respond to specific requests for technical assistance. In addition, pest identification and diagnostic services will be provided, and an information service center will be established to organize and distribute technical information required to facilitate the development and implementation of IPM in the region.

3. Summary Financial Plan ($000)

	ROCAP	CATIE	Total
Personnel Costs	2,741	588	3,329
Training	946	50	996
Equipment	441	--	441
Travel & Per Diem	400	--	400
Other Costs	230	112	342
	4,758	750	5,508
Inflation/Contingency	765	--	765
	5,523	750	6,273
Overhead	1,227	--	1,227
	6,750	750	7,500

C. Summary Findings

The Project Committee has reviewed all aspects of the proposed Regional Integrated Pest Management project and finds that it is technically, institutionally, financially, socially and environmentally sound (see Section V and technical annexes for detail). The economic analysis shows that extended benefits of the project will yield an internal rate of return of greater than 15%

(see Section V.C and Annex I-H). The Committee also finds that the project is consistent with the objectives set forth in the ROCAP CDSS and AID/W policy guidance.

The CA/P USAIDS have been consulted extensively during the development of the PP through visits to each Mission by the consultant team, and special efforts have been made to complement activities of the proposed project with ongoing projects related to IPM in Panama, Honduras and El Salvador. The final draft of the PP was distributed to the USAIDs for review, and their comments have been considered in preparation of the document submitted to AID/W. Based on these consultations, the Committee believes that all major issues have been resolved and that there is agreement among the USAIDs that the project is an appropriate regional initiative which complements bilateral activities and should be approved.

II. PROJECT BACKGROUND AND RATIONALE

Early in 1984, ROCAP fielded a multidisciplinary team of specialists -- in plant pathology, weed science, entomology, pesticide management, agronomy, economics, sociology, and information science -- to analyze requirements for the proposed project and to assist the Mission in its design. Between January 22 and March 9, the team consulted with representatives of USAID Missions, CATIE, national ministries of agriculture, national universities, agricultural schools, Peace Corps, other regional and international institutions, and the private sector in Costa Rica, El Salvador, Guatemala, Honduras, and Panama. Information obtained in field visits (see Annex II-C for list of contacts) and reports, bulletins, project documents, and other information made available to the team formed the technical basis for the design of the project.

A. The Challenge Facing Agriculture in Central America and Panama

Agriculture has historically been the backbone of the economy of Central America and Panama. In 1980, agriculture accounted for approximately 25% of the CA/P region's gross domestic product. In that year, exports of coffee, banana, cotton, and beef were estimated at $2.6 billion -- about 55% of the region's total export earnings. More than half of the CA/P's labor force is directly employed by agriculture, and a significant portion of the remaining labor force is employed by agricultural businesses (food processing plants, textile industries, etc.)

An examination of recent trends raises questions about the ability of the CA/P region to meet future demands for the production of basic food, industrial, and export crops. In recent years, no CA/P country has been self sufficient in the production of basic foods, and income from the region's principal export crops has decreased. Population expansion in the region (2.3% annually) has put tremendous pressure on natural resources, forcing agricultural production onto marginal lands and diminishing forest and watershed resources.

Most of the small farmers in the region still practice a form of traditional agriculture, characterized by mixed cropping and livestock systems, polyculture (growing of two or more crops simultaneously on the same field in the same year), local, often unimproved varieties, little or no artificial fertilizers, pesticides, or other capital inputs, and minimum tillage. A significant portion of the small farmers are situated in climatic zones that are less than optimal for good yields. Harvesting operations are often facilitated by human labor or draft animals, and a majority of the

harvest is usually consumed by the human inhabitants and domestic animals on the farm where produced.

In this context, the challenge facing the agriculture sector in the region is to increase the yields and earnings of small farmers who have limited access to capital and technology. These farmers are a highly significant element in agricultural production in CA/P, comprising about 65% of the region's population of farmers and producing some 75% of the maize, beans, and sorghum grown in CA/P (i.e., the basic foods for the region).

To meet this challenge, improved and high yielding varieties, fertilizers, mechanization, and other "modern innovations" are being introduced into traditional agricultural areas. Parallel with these activities, pesticides -- particularly insecticides and herbicides -- are being utilized in increasing levels.

Nonetheless, a number of technological, economic, institutional, and attitudinal barriers must be overcome before the full potential of modern techniques can be realized. A key obstacle to increased agricultural output in the CA/P region is the inadequacy of crop protection in the region. For most small farmers, there are no organized methods of crop protection. Some farmers simply tolerate pests or rely on natural forces to control them. Others may rely on chemical means, but few CA/P farmers are able to properly diagnose pest problems or apply pesticides correctly and safely. Pesticides, when used, are frequently applied haphazardly, often involve unnecessary production expenditure, and present a hazard to human health and the environment. (Use of pesticides on cotton has resulted in serious health and environmental problems in the region. These are discussed in the economic analysis and the environmental assessment of pesticide use in annexes I-H and I-J, respectively).

Historical evidence from other regions of the world shows that as agriculture intensifies pest problems grow. The ability of pests to adapt to protective cropping environments exacerbates the problem. Unless alternative actions are taken, therefore, the situation in CA/P can be expected to worsen as efforts to increase crop yields in traditional agricultural areas continue.

B. Integrated Pest Management: Appropriate for CA/P Agriculture

Experience with many crops in many parts of the world, both developed and developing, has shown that yield increases and yield stability are more likely if the burden of crop protection is

systematically spread over a combination of biological, cultural, physical, and chemical methods. The evolution of genetically resistant strains of pests that no longer can be controlled profitably by chemical means has dramatized the point that any control practice -- if applied unilaterally -- can have unexpected and undesirable consequences.

Integrated pest management, as the term suggests, integrates a variety of techniques, including natural predators, pathogens, parasites, genetically resistant hosts, environmental modifications (cultural practices), and, when necessary and appropriate, chemical pesticides. Generally, IPM programs first use nonchemical defenses against pests before altering the environment with chemical pesticides or requiring the capital investment impositions of pesticide purchase. After the ecology of the offending pests and pest complexes is studied, and the cost effectiveness and environmental suitability of potential control measures have been determined, IPM techniques are harmonized in an organized way to best suit the target user or user group.

Experience has emphasized the need for coordinating all control practices for each pest affecting a given crop into one cohesive system. A given crop, for example, is rarely confronted with a single pest problem, but rather with a range of pest problems: different kinds of insects, mites, disease-causing organisms, weeds, and sometimes rodents, slugs, and other pests. The pest problems are especially complex in the tropics. Measures to control one pest may create or intensify other pest problems, which may also be exacerbated by extremes in weather. Consequently, pest control recommendations should not evolve independently for insects, weeds, nematodes, diseases, or other pests, nor can optimal control strategies be developed without considering the cropping system as a whole.

Integrated pest management provides a long-term strategy for minimizing losses caused by pests with the least possible cost to the farmer and disruption of the environment. IPM treats pests as a component of the total system of crop production, which includes not only the interactions among the crops and the pests that affect them but also the physical, biological, and socioeconomic environments in which the crops are grown and the pests proliferate. Annex II-B provides guidelines for the development and application of IPM programs.

By drawing heavily on cultural practices, genetically resistant plants, and other non-chemical techniques, IPM can reduce pest losses on a continuing basis at a reduced cost when compared to control achieved strictly by chemical means. IPM also reduces the

risk of crop failure often associated with crop protection programs based on single practices. Under IPM, even if one of the control techniques fails, one or more of the others may still provide protection. Finally, it reduces the health and environmental hazards associated with crop protection programs based heavily on pesticides.

C. Rationale for a Regional IPM Approach

IPM concepts were first introduced in CA/P in the late 1960's. However, most of the efforts to date have been short-lived and have lacked continuity. In addition, most of the early IPM research in Central America has focused on traditional export crops, i.e., cotton, cocoa, banana, coffee, and sugarcane, and little effort has been devoted to pest problems or control alternatives on basic food crops. Moreover, there has generally been poor communication and cooperation among personnel in charge of the different activities, resulting in considerable duplication of effort. In fact, many of the materials and research results developed in one country are unavailable and/or unknown to professionals in the others.

The regional approach to IPM proposed by this project has considered the problems associated with past IPM efforts and is designed so as to take advantage of the following factors:

-- No one country in the region has sufficient specialists trained in crop protection (entomologists, plant pathologists, nematologists, and weed scientists) to develop and implement effective national IPM programs in research, training, and technical cooperation. In some countries, the "specialists" have had no formal training in their disciplines. They became specialists by appointment and usually discharge their duty without proper guidance. Further, rather than working in interdisciplinary teams, specialists generally work in isolation in their separate disciplines. IPM must evolve as an interdisciplinary effort with the different disciplines working together in teams. The regional approach provides a cost effective means for assembling the required IPM disciplines into one coordinated group capable of addressing common problems.

-- Pests do not recognize national boundaries. Because of the regional commonality of many pest problems and cropping systems, and the relatively limited resources of the individual countries, adaptive IPM research and specialized training can be provided more effectively

through a regional project. In addition, a regional IPM-oriented project can introduce needed stability and continuity into national programs, since the benefits derived from any one national IPM program will be greatly magnified by the inter-country transfer and exchange of information, technology, and technical expertise.

-- Regional cooperation, properly focused, can result in economies of scale through the concentration of technical expertise in an easily accessible location which is capable of responding to problems common to several countries (see Economic Analysis, Annex I-H).

D. Advantages of Regional Coordination by CATIE

CATIE was created to provide the region with an agricultural research and training center. As such, it is the logical choice to implement the project. Moreover, CATIE offers several unique advantages as the implementing institution:

-- It has a well established infrastructure and capacity for research, training, and information management. In research, CATIE already has significantly influenced the orientation of agricultural research activities within the CA/P region. For training activities, CATIE has considerable experience in providing courses, seminars and workshops at the CATIE headquarters as well as in the countries. In the area of information management, CATIE has already created a data base for crop pest organisms in the CA/P region. This data base will be an important input for both the pest diagnostic and information services objectives of the IPM project.

-- Linkages exist with national institutions which facilitate implementation of regional programs. A recent evaluation of CATIE by Coopers and Lybrand highlighted the effectiveness of these linkages. In its final report of February, 1984, Coopers and Lybrand concluded: "It (CATIE) is perceived as an effective implementor of projects by sponsoring agencies as well as by the national government counterparts with which it carries out most of its project activities."

-- It has the capacity to develop and transfer appropriate technologies as demonstrated by the success of the Small Farm Production Systems project from which the results and methodologies have been widely accepted at

the national level. Also, the proposed project will be building on those results.

-- Its regional character allows CATIE to function relatively free of the economic and political constraints that usually affect national institutions, and gives the organization stability and continuity that national and bilateral projects often lack. Likewise, CATIE's location in a country free of many socio-political problems now affecting much of the region further adds to the stability and continuity required for successful leadership.

-- By developing a centralized source of expertise, the region can depend on a local institution and CATIE itself can generate income by charging for services, thereby permitting it to maintain a permanent capacity for IPM research, training and technical assistance in the region.

E. Relationship of the IMP Project to AID Policy and Projects

1. Relationship to AID Policy

"Crop and animal protection (pre and post-harvest) by most cost-effective and environmentally acceptable means" is among the five highest priority research concerns identified in the November 22, 1983 LAC Agricultural Research Priorities Implementation Plan. Under this priority, the following research topics are identified:

-- Plant diseases, insects, nematodes, and weeds

- Identification and characterization of the most important pests and their damage potential in various countries of the region. [i.e., crop loss assessment]

- Development of varietal resistance to selected plant diseases, insects, parasitic weeds and vertebrate pests.

-- Integrated pest management

- Development and evaluation of simple, inexpensive techniques for sampling pests and their natural enemies to establish economic thresholds of infestation for early warning or forecasting

systems in intensively cropped areas to determine the need for control or shift in emphasis in pest problems, or both.

- Development of pesticide-herbicide-biological control management systems, including traditional production methods, emphasizing cost effectiveness including evaluation, introduction, and establishment of parasites and predators.

The activities planned under this project conform perfectly with this priority research concern of the Agency.

2. Relationship to ROCAP Strategy and Projects

The IPM project is fully consistent with ROCAP's development strategy. The FY 1985 ROCAP CDSS stresses (1) the strengthening of the technical capacity of the regional institutions to fulfill their basic mandate of transferring technologies to the national level counterparts, and (2) the importance of an improved analytical capacity in agriculture through an improved ability to collect, manage, analyze, and store agricultural data and information. The proposed project is essentially institution building in character and will draw on the experience gained from previous ROCAP projects with CATIE, particularly the Small Farm Production Systems project which includes a small amount of pest control research. The project will also benefit from the activities over the past three years of the Regional Pest Management Specialist (RPMS) on the ROCAP staff whose work throughout the region has had a major role in identifying the need for a regional IPM project. The RPMS will continue providing assistance to bilateral programs, and this interaction will be important for insuring that the regional project is responsive to the bilateral projects.

In ROCAP's current portfolio, the Coffee Rust project is the activity most closely related to the proposed project. That project focuses exclusively on controlling coffee rust and coffee bean borer, with the most important element being research to develop resistant varieties of coffee plants. The project also includes research on other techniques for controlling pests (e.g., shading, spacing, pruning, land tillage and, to a limited degree, the use of pesticides) which may provide results useful to the IPM project.

3. Relationship to Bilateral USAIDs

During the design phase of this project, the USAID Missions in Guatemala, Costa Rica, El Salvador, Honduras, and Panama were visited and discussions were held to identify more specifically the ways in which the regional project could assist the bilateral projects and vice versa.

Three bilateral USAID projects currently focus exclusively or partially on IPM. In El Salvador, a project is developing and establishing IPM technology in a pilot zone of 7000 hectares of cotton. The project is being implemented by Salvadorean research personnel trained at the B.S. level who receive only limited outside technical assistance in advancing their IPM effort.

When interviewed by the project design team, the cotton IPM personnel in El Salvador expressed considerable interest in the regional IPM project and requested assistance in several areas. Their principal interest is in the technical support the regional IPM project will offer, including guidance in biological control, experimental design and data analysis, cotton IPM, plant pathology, and weed control. The regional project will also assist in providing technical literature, identifying pest specimens, and organizing and presenting seminars, workshops, and short courses in specific IPM topics. A further contribution will be in providing the opportunity for cotton IPM project personnel to participate in crop protection seminars and conferences in and outside the region.

In Honduras, a corn and beans IPM project is under implementation based at the Panamerican Agricultural School, (El Zamorano) and includes research and training components. The research component seeks to develop alternative control methods for the whorlworm and a slug, major pests of corn and beans, respectively. The second component trains students and project personnel in various areas of IPM, while strengthening the institution's research and training capability in crop protection. The two projects will benefit from a collaborative effort in carrying out seminars, lectures, workshops, and short courses in specific areas. Facilities at El Zamorano are excellent for training and will be utilized for carrying out workshops and short courses sponsored by the regional project.

There are two USAID-funded projects in Panama involving crop protection. The development of agricultural technology project includes the designing of an IPM program for major crops at the national level by personnel from the Agricultural Research Institute (IDIAP). The transfer of agricultural technology project involves the training of ministry of agricultural development extension

personnel in crop production and protection. Support from the regional IPM project to IDIAP staff will include the assistance of IPM specialists in identifying crop protection problems and suggesting pest control alternatives. Likewise, the regional project will assist ministry personnel with training programs in areas such as pesticide management and safety, pest identification, crop specific IPM practices, as well as in organizing workshops for growers. Further support is expected to include biological specimen identification, access to technical literature, and helping to establish insect reference collections.

III. PROJECT DESCRIPTION

A. Goal, Purpose and Beneficiaries

The goal of the project is to increase agricultural productivity in Central America and Panama and to enhance the health and living standards of rural families in the region.

The purpose of the project is to strengthen national and regional capabilities for development and implementation of effective integrated pest management in Central America and Panama.

Due to its institution building character, the project will have direct and indirect beneficiaries. Those to benefit most directly will be CATIE staff which will have an increased technical capacity in IPM and the ability to deliver it to the national level. National institutions and private sector concerns associated with agricultural production will also benefit from the availability of an expanded pool of expertise to call on for assistance, as well as from participating in the training activities planned under the project.

Equally, and perhaps more important than these direct benefits will be the long-term indirect benefits of the project. The entire agriculture sector will benefit from increased productivity and income as a result of IPM. In particular, the small and medium sized farmers in the region will benefit because IPM does not require high investment costs which they could not afford, yet it will allow them to increase production and incomes. Also, the general welfare of the region's population will be improved because of the environmental and human health benefits that will result from a more rational use of pesticides.

B. Location of Project Activities

In addition to activities at CATIE's headquarters in Turrialba, Costa Rica, it is planned that activities be carried out in Guatemala, El Salvador, Honduras, Costa Rica and Panama. The benefits from the project will accrue equally to all of the participating countries. In addition, tropical countries outside the region will benefit as the technologies and information will apply to a wide range of tropical cropping systems in the Americas, Asia and Africa.

C. Crops and Cropping Systems to be Emphasized

Cultural and environmental characteristics vary within the region; consequently, so do the mix of crops and animals produced. At the small farm level, CATIE's research indicates that production systems can include up to ten crops. In addition, these systems usually include pasture, fallow land, forested areas and home gardens.

Typically, basic grains (including beans) occupy 20%-40% of the total cultivated land area. The remaining cultivated land is planted to other food crops and cash crops. The types of nongrain food and cash crops produced by small farmers differ according to ecological zone and local preference.

To succeed, therefore, the project must approach IPM holistically, examining all crops and crop mixes that may be important to small farmers. With this in mind, among the first project activities will be general crop loss assessments which will be used to establish research priorities (see Section III.D.2).

Although crop loss assessments will be used to set priorities, the existing body of information on the importance of certain crops for most small farmers make it possible to identify those crops most likely to receive attention. Specifically, the research component will emphasize the pre-harvest pest problems of maize, beans, rice, sorghum and plantain. As results from crop loss assessments become available, other crops will also be considered and research priorities adjusted as appropriate. The training and technical components will not be restricted to any particular crops or cropping systems, and will also include post-harvest pest control problems.

D. Project Components

1. Introduction

Three complementary and overlapping components have been designed to meet the region's needs in establishing IPM as an important element in agricultural production: research, training and technical cooperation. Each component includes activities which respond to the concerns identified by the PP design team in discussing the proposed project with public and private sector individuals through the region, including technicians working on IPM related projects funded by A.I.D. in Panama, Honduras and El Salvador.

The close interaction of the three components make it possible for the project to achieve a high degree of cost-effectiveness by sharing many inputs among the components.

The most important of these inputs will be a team of IPM specialists and technical support personnel who will form the core of expertise at CATIE. The team will coordinate all project activities and will carry out research, serve as instructors for training activities and provide technical assistance. The composition of the team incorporates the disciplines necessary to provide the holistic approach required by IPM. The team of IPM specialists will be complemented by research assistants and field technicians who will permit the specialists to maximize their input into all project activities. The research assistants will be junior level professionals with M.S. degrees who, by virtue of working closely with the specialists, will receive on the job training and, by the end of the project, will have the technical skills required to carry out IPM research, training and technical assistance on a continuing basis. It is expected that they will form a permanent core staff at CATIE for this purpose.

The basic team will include*:

-- An IPM specialist who will serve as team leader and have overall responsibility for coordinating project implementation.

-- An entomologist who will also be the coordinator of pesticide research activities.

-- A plant pathologist who will have responsibility for pest diagnosis services.

-- A weed scientist/agronomist who will coordinate training activities.

-- An information specialist to make IPM information readily available for research and training purposes.

-- An economist to carry out assessments on the impact of introducing IPM in the region.

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*See Annex II-A for detailed job descriptions.

In addition to the team at CATIE, the project will use the model first established in the Fuelwood project of placing project coordinators in the five participating countries. These coordinators will be the link between national institutions (public and private sector) and the project staff at CATIE. To maximize the effectiveness of the coordiators and to provide assistance on research activities that will be carried out, the project will also include research assistants at the national level.

All of the above project staff are presented in this introduction because they will work in each of the components. For simplification, in the remainder of this section they will be included only under the Research component discussion on inputs.

Another common element to each of the components will be a national advisory committee to be established in each country. The committees will bring together all individuals and groups (public and private sector) involved in agricultural production and who have an interest in crop protection. The country coordinators will act as advisors to the national committees, but it will be the committees themselves which will review and advise on the project's operations and progress. An important function of the committees will be to identify priority areas for input by the project. For the private sector, in particular, the committees will provide ample opportunity to assure that the project responds to their needs.

2. Research

a. Description

Under this component, IPM practices applicable to small farm production systems will be identified and tested. Much of the research will be based on existing technologies and will be carried out both at CATIE and on selected farms in the participating countries. Site selection for on-farm trials will follow the methodology developed under the Small Farm Production Systems project.

The impact and effectiveness of the research will be strengthened by linkages with several national institutions. These include the Instituto de Ciencia y Tecnologia Agricola (ICTA) and the Direccion General de Servicios Agropecuarios (DIGESA) in Guatemala; the Programa Nacional de Investigacion Agricola (PNIA) and the Escuela Agricola Panamericana (EAP) in Honduras; the Centro Nacional de Tecnologia Agropecuaria (CENTA) and the Direccion de Defensa Agricola (DDA) in El Salvador; the Ministerio de Agricultura y Ganaderia (MAG) and Universidad de Costa Rica (UCR) in Costa Rica; and the Instituto de Investigacion Agropecuaria de Panama (IDIAP) and the Universidad de Panama in Panama.

Three areas of research are planned: crop loss assessments; approaches and methods of IPM, including pesticide use and management; and socioeconomic research. Table 1 presents a summary of the expected outputs of the research component.

1) Crop Loss Assessment

To date, efforts to assess the quantitative importance of pests and pest complexes, both on principal crops of the CA/P region and across extended cropping and ecological zones of the region, have been insufficient. It is possible that some major pest problems of regional crops have gone unrecognized or the economic importance of other pests has been misinterpreted.

Knowledge of the socioeconomic importance of pest problems provides the basis for establishing priorities for IPM research: identifying where pest-related crop losses are most significant dictates where research should begin. This knowledge also is necessary for establishing the rationale for pesticide use, for indicating training needs, and is important to pest diagnostic services. The need for crop loss assessments is continual so that appropriate adjustments and modifications can be made in research activities as new information becomes available.

a) Objectives

- Identify the most important pest problems in small farming systems of the CA/P region.

- Estimate the economic impact of these pest problems.

- Determine whether farmers have accurately assessed the importance of these pests.

b) Approach

To initiate the assessments, the project will sponsor a regional workshop during the first year to which the region's experienced crop protection specialists will be invited. Based on their experience, the participants will provide a first approximation of the pests that are likely to be most important to crop losses by identifying and ranking the importance of weed, insect, pathogen, nematode and other pest problems affecting small farmer systems in the region. This information will be cross checked with information obtained from a sample survey of small farmers in which they will be asked to identify important pest problems. Additional information will be gathered from a literature search on losses caused by major pests.

TABLE 1

SUMMARY OF RESEARCH COMPONENT

Activity	Outputs
1. Crop Loss Assessment	. 2 regional workshops on identifying major pests causing crop losses. . Computerized list of major pests for 10 small farm crops. . 100 economic thresholds identified for major pests of small farmer crops
2. Approaches and Methods in IPM	. 100 field tests of IPM practices on small farm sites. . IPM practices identified by research validated on 150 small farm sites. . Pesticides most compatible with IPM identified.
3. Socioeconomic Research	. Guidelines for economic evaluation of IPM developed and established. . Incorporation of socio-economic evaluation in field tests and validation of IPM practices.

Together these three activities will permit the development of a preliminary set of crop loss guidelines, including assigning economic values to these losses, and the establishment of research priorities. The initial information base will be subjected to appropriate field tests throughout the life of the project to ascertain the actual importance of any pest in question. As the tests -- which will be conducted on on-farm sites -- are completed, it will be possible to adjust research priorities as well as the actual economic loss values that can be attributed to the various pests.

In the fourth year of the project, a second workshop will be held for the crop protection specialists in the region to compare research results with earlier perceptions. As appropriate, special training exercises based on the research results will be held to expand the knowledge of the region's crop protection specialists.

2) Approaches and methods in IPM

Long-term, on-farm experience in many tropical countries with a variety of crops has produced a series of thoroughly tested guidelines for the development and implementation of IPM. These guidelines follow a logical pattern and sequence so that when IPM technology is produced, it is adaptable and suitable to the socioeconomic environment of the target farmer. The methodological steps are given in detail in Annex II-B, and the entire research effort in IPM proposed for this project will evolve sequentially as described therein.

Although information from the crop loss assessments just described will not be available at the start of the project, previous knowledge and experience in IPM development and implementation make it possible to identify certain crops and pests where research will likely receive high priority. As crop loss assessments generate new information, these priorities will be subject to changes. Examples of priority areas include:

- The efficacy of combining cultural control methods and host plant resistance for control of Black Sigatoka of plantain.

- The yield-improvement effects of the traditional "tapado", or "covered bean," system for weed and disease control in beans.

- The interaction of tillage methods and crop residue management for control of weeds, insects, and disease in maize, beans, rice, and sorghum.

- The use of herbicides to improve yields in traditional small farm production systems.

- The dynamics of weeds and their management by ecological manipulation.

- The efficacy of biological control agents (pathogens and parasites) of lepidopterous pests of maize.

An important element in the IPM research will be the use of chemical pesticides. Pesticides offer a convenient, rapid, effective, and economic approach to pest management, if used properly. Frequently, however, pesticides are misused, leading to certain secondary effects of significant biological, economic, environmental, and health consequence.

Research on pesticides will focus on ensuring their effective integration into IPM programs. The orientation will be on finding cost effective materials and application procedures that assure worker protection and minimal harm to the environment.

a) Objectives

- Develop fundamental information on principles and practices for control of pests that adversely affect the production of principal small-farm food and cash crops in Central America and Panama, including pathogens, weeds, insects, nematodes, rodents, and birds.

- Establish small-scale on-farm research studies for preliminary evaluation of new IPM technologies.

- Conduct field scale on-farm tests to validate promising IPM technologies.

- Evaluate, select, and use pesticides and pesticide application techniques most compatible with IPM systems, with primary attention to applicator safety.

b) Approach

The research will be both fundamental and applied and will be carried out under controlled conditions on experimental stations as well as on farm at selected sites in the region. To assure that results are correct and appropriate for transfer, several trials and evaluations of research results are planned over the entire implementation period of the project.

The on-farm research component will be initiated by small scale testing to gain preliminary information on new IPM methods and materials that have not been adequately evaluated in a real production situation. The small scale research phase will involve small plots established on selected farms.

Next, the on-farm research will be established in large field plots on selected farms, or on entire farms for purposes of testing and validating promising IPM systems. The IPM systems will integrate the use of modified planting date, increased plant population, selective insecticides and herbicides, disease and insect resistant plants, traditional cultural practices, and biological control. This phase of the research will permit a comprehensive evaluation of the crop pest complex for biological, socioeconomic, and environmental variables.

When research on a given grop pest complex is completed and the results are ready for transfer, project staff will prepare materials on the results obtained which will be used for training purposes as well as to provide basic information for technicians working on crop protection.

3) Socioeconomic research

Under this activity, appropriate socioeconomic variables will be examined to measure the acceptability of the pest management technologies developed and tested under the project. All phases of research -- planning, development, implementation, and evaluation -- will be carried out with relevant socioeconomic factors included in the design. This is an important aspect of the IPM approach which recognizes that improved technology is of little value if it is not adopted and used by its intended beneficiaries. Sociologists, anthropologists, and other social scientists will be consulted regularly by the project team in order to assure proper consideration of important socioeconomic concerns.

a) Objectives

- Consider socioeconomic constraints in the design of IPM research efforts.

- Incorporate appropriate socioeconomic inputs to the assessment of IPM strategies developed in the project.

- Analyze economic and sociological factors affecting transfer of IPM technology in CA/P.

b) Approach

The economist on the IPM team at CATIE, with assistance from sociologists, anthropologists, and other social scientists, will review IPM research alternatives, assess the expected successes, and interpret research results in relevant socioeconomic terms.

B. Implementation

Planning for research activities and establishing priorities will begin as soon as the IPM Specialists are employed at CATIE. The initial workshop to identify pest-related crop losses will be conducted within 9 months after project initiation. Farmers residing in potential research areas in the participating countries will also be surveyed as part of the crop loss assessment activities. The surveys will use sample procedures developed by the "Perceptions and Management of Pests and Pesticides" Group, which is an international body with considerable experience in this field.

During the first year of the project, research activities on IPM approaches and methods will be modest since the initial crop loss assessments will not be complete. However, some research on immediately identifiable problems will be conducted (see discussion above on approaches and methods of IPM). Concurrently, the project team will develop the plan for IPM research, including pesticide management, and selection of farm sites for field studies using the same or similar criteria to those used by the Small Farm Production Systems project. Research activities will increase in year two as crop loss assessments are completed and priorities are established.

A general time frame for various research-associated activities is shown in the implementation plan which is set out in detail in Annex I-L.

C. Inputs

The project will fund personnel costs of six senior specialists, four research assistants, an administrative assistant,

five country coordinators and five national level research assistants, technicians to carry out field work, and short-term consultants.

Equipment and supplies to be funded specifically under this component include:

Backpack pesticide sprayers, pesticide safety devices and clothing, portable scales, a drying oven, desktop calculators, field tools, general lab and field supplies, pesticide, fertilizers, and seeds. One vehicle in each country will be provided to permit continual and timely access to research sites. Two vehicles at CATIE for project staff will also be funded by the project. The CATIE contribution includes salary costs of project staff beginning in year four, teaching facilities, and research sites. At the national level, contributions will include limited periods of time of professional and technical personnel and research sites.

2. Training Component

a. Description

Currently, there is a lack of personnel trained in intergrated pest management in the region, yet training of extensionists, researchers, teachers, public and private sector officials, and farmers is essential to the successful development and implementation of IPM practices (see Technical Analysis, Annex I-F). Training must be specially tailored in order to communicate the principles and applications of IPM to different audiences. Practical, field-oriented training is required for extension officers and others working in IPM implementation at the farm level, whereas highly technical short-term training is required for researchers and those in charge of developing specialized programs such as pest diagnosis and pesticide management. To develop a continuing regional capacity in IPM, the introduction of appropriate courses at high schools, universities, and post-high school agricultural schools is required.

Ultimately, of course, the farmers must also be trained in the use of IPM techniques. National institutions collaborating on the project will be responsible for the large scale extension of training to farmers.

The activities of this component will be carried out at three levels in addressing the region's IPM training needs: (1) specialty training for project personnel; (2) short-term training; and (3) academic and in-service training.

In addition to these training activities, a variety of training material will be developed under this component, including manuals, cassette tapes, audiovisual slide sets, complete training packages, and study guides on IPM and selected IPM topics. These materials will be used primarily to strengthen other IPM training efforts being carried out in the region (such as the Escuela Agricola Panamericana) or to provide some input into the curricula in high schools, universities or post high school agricultural schools.

Also, the project will tap existing sources of training and information materials -- private industries in the U.S. are an excellent source -- and make them available throughout the region.

Table 2 summarizes the Training Component and the expected outputs.

1) Specialty training for project personnel

The personnel brought together by the project will be experts in the various technical disciplines incorporated in IPM practices. It is expected that each will have had some experience in implementing IPM projects. Nonetheless, to assure that the team is well integrated and working from the same basic principles and understandings, a special workshop is planned to provide the team with a common knowledge base. The workshop will occur as early as possible after the entire staff is in place. Crop loss assessment, pest diagnosis, pesticide safety and management, and post-harvest crop protection are among the topics to be covered in the four week workshop. Special consultants will be brought to CATIE to work with existing CATIE staff in providing this training.

2) Short-Term Training

While visiting the participating countries during the design phase, the PP team identified a series of short-term training requirements to raise public awareness on the potential impact of IPM and to provide the means of transferring IPM technology. The groups contacted included administrators in public sector institutions, research technicians, extension personnel, teachers, agribusiness personnel, public health personnel working on pesticide management or poison control and treatment, and Peace Corps volunteers. The interest expressed by these individuals for appropriate short-term training was extremely high.

Given the interest shown, the short-term training activities constitute the project's most important outreach effort because of the broad audience which can be reached. A series of 42 seminars and workshops directed at these audiences have been

TABLE 2

SUMMARY OF TRAINING COMPONENT

Activity	Outputs
1. Specialty Training for Project Personnel	. 1 Seminar for project staff on recently developed principles and practices in IPM.
2. Short-Term Training	. 13 seminars on selected IPM topics for 140 participants. . 29 workshops for 750 participants. . 1 final project seminar per country with 200 participants per seminar
3. Academic & In-Service Training	. 4 professionals complete Ph.D. in U.S. . 15 professionals complete M.S. at CATIE . 15 professionals complete academic, non-degree training in the U.S. . 11 technicians complete study tours.
4. Training Materials	. 25 training modules on IPM principles, methodology and practices developed.

identified. They will have a duration of 1 day to 2 weeks and will be conducted primarily in country in order to maximize participation and minimize costs. Topics for the training courses will include a general introduction to IPM and its concept, utility and limitations; pest management economics including basic theory and methodology; application of IPM techniques; and the principles of pesticide management, including safe handling, use and disposal. For the seminars and workshops held in the third and fourth years of the project, initial results from research activities will be available to demonstrate the impact of IPM. In the final year of the project, a wrap-up seminar will be held in each country to provide the target audience with more detailed results from project-sponsored research. Approximately 1,900 participants are expected to be reached by the various workshops and seminars. Table 3 provides a summary of the planned training.

In addition to the planned seminars and workshops, the CATIE staff will conduct special training activities when a specific need is identified. It is expected that these will be primarily for technicians working on the IPM projects in El Salvador, Honduras and Panama, although every effort will be made to respond to requests from other groups as well. In Honduras, the project plans to coordinate with the EAP for the use of facilities at El Zamorano to carry out training activities which will permit an even closer link between the two projects.

Although not a specific training activity of the project, high schools and post high school, non-degree agricultural institutions in the region will be encouraged to include IPM in their curricula. Project staff will be available to visit these schools and provide some assistance in training activities. Also, materials developed for the workshops and seminars, as well as research results, will be made available to these schools.

3) Academic and in-service training

a) Academic

Two types of academic training are planned: M.S. or Ph.D. training in the U.S., and M.S. training at CATIE and national universities.

i) U.S. Training

A limited amount of specialized training in IPM at U.S. institutions is planned to strengthen the core of IPM experts in the region. Normally, long-term training in the U.S.

TABLE 3. SHORT-TERM TRAINING IN IPM, PESTICIDE MANAGEMENT, AND PESTICIDE MANAGEMENT ECONOMICS

Target Audience	Workshop or Seminar	Estimated size of Audience per session	Total No. Sessions during project	Duration of each session	Location	Timing	Trainers
1. Administrators	Seminar	10	2	1 day	CATIE	1st and 4th year	Project personnel
2. Research and University teachers	Workshop	15	10[a]	1 week	In Country	2nd and 3rd year	Project personnel
3. Extension personnel and High-School Teachers	Workshop	50	10[a]	1 week	In country	2nd and 4th year	Project personnel
4. Agribusiness personnel	Seminar	20	1	2 days	CATIE	2nd year	Project personnel
5. Public health personnel	Seminar	10	10[a]	2 days	In Country	2nd and 4th year	Project personnel
6. Peace corps Volunteers	Workshop	10	2	1 week	CATIE	2nd and 4th year	Project personnel
7. Researchers and University teachers	Workshop	20	1	2 weeks	CATIE	2nd year	3 consultants with extensive experience in pesticide management and agromedical practices
8. Extension workers, administrators and agribusiness personnel	Workshop	10	5[b]	3 days	In Country	2nd year	Project personnel
9. Economists from CATIE and CA/P region	Workshop	10	1	5 days	In Country	2nd year	Consultant with long-term specialization in pest management economics
10. Extension workers, administrators and agribusiness	Seminar	200	5[b]	3 days	In Country	5th year	Project personnel personnel

a/ Two per country
b/ One per country

would not be proposed under a regional project; however; the availability of resources from Central Bureau sources (e.g., the LAC Training Initiatives project) specifically for advanced degree U.S. training provides an opportunity for bringing added benefits to the region. Project staff will identify potential candidates through contacts with national counterparts as well as from participants at short-term training activities. Actual training costs will be funded from other sources. A total of four advanced degrees (M.S. or Ph.D.) are proposed.

ii) Regional Training

These activities will focus primarily on amplifying and strengthening the existing M.S. degree in cropping systems offered by CATIE by including specialized courses in IPM. CATIE's current degree program is formally sanctioned by and carried out under the auspices of the University of Costa Rica (UCR). The agreement which facilitates this training is now being discussed with the intent of renewal, and a degree program in the crop protection area is contemplated.

UCR has a number of qualified faculty in entomology, nematology, plant pathology, and weed science which cover the core courses in crop protection. It is expected that the major share of formal core instruction for the new degree program will be the responsibility of UCR, with assistance from CATIE staff. The project design team visited UCR faculty in San Jose and discussed this joint UCR-CATIE effort. UCR is eager to cooperate in developing a crop protection degree program for students throughout the region. Over the life of the project, it is expected that 15 students will complete the M.S. program in crop protection.

Supplementing the graduate training at CATIE/UCR are academic and graduate programs at national institutions in the region. The project will support these programs through the provision of instructional materials, information leaflets and audiovisual materials; and by offering special courses in crop loss assessment, pest diagnostic methodology, and IPM development and implementation. As demands on project staff permit, they will also assist students by providing guidance on research activities aimed at a graduate degree.

b) In-Service Training

A foreign study program and specialized study tours are planned as part of this activity .

i) Foreign Study Program

The objective of this program is to enable professionals who have graduate degrees in IPM related fields to benefit from additional specialized training. Post graduate (non-degree) study at U.S. or Latin American universities or other training centers is planned. As with the long-term academic training, the design contemplates using funds available from existing or planned scholarship programs. Project staff will identify potential candidates and direct them to the sources of the training funds (ROCAP or bilateral USAIDs). A total of fifteen professionals will be trained for up to one year under the program.

ii) Study Tours

This activity will provide regional and national personnel with the opportunity to observe applications of crop protection technologies in other countries in Central America, the Caribbean and, in some cases, the United States. Special emphasis will be given to pesticide residue [illegible]sis, virology, crop loss assessment and data base management in [illegible]ng the locations for the study tours. Participation will be [illegible]d to eleven professional level technicians.

b) Implementation

The weed scientist/agronomist of the IPM team will serve as the project's training coordinator. The entire project staff, however, will participate in organizing training activities, preparing training materials and conducting training sessions. The country coordinators will play an important role as the link between CATIE and the targeted training audience.

c) Inputs

In addition to the staff already described under the research component, project funds for the training component will finance specialized short-term consultants, travel and per diem costs for project personnel and trainees (including in-service training), training materials and supplies, books, audiovisual equipment, 15 scholarships for M.S. training at CATIE, and costs for publishing training materials. CATIE and national institutions will provide all necessary training facilities. The cost of U.S. academic and in-service training will be funded by non-project sources.

3. Technical Cooperation Component

A. Description

The objective of this component is to establish the capacity at CATIE to provide services in IPM to public and private sector institutions and individuals in CA/P. The following services are planned:

-- Pest diagnostic services, aimed at increasing regional and national capabilities in pest identification and diagnosis.

-- Regional IPM information services, through a center established at CATIE to organize and distribute information needed to augment IPM research, training, and technology transfer in the region.

-- Technical assistance, aimed at providing short-term assistance in IPM practices to national institutions, including private sector individuals or groups.

Each of these services will be integrated into and synchronized with the research and training components of the project. Expected outputs from this component are summarized in Table 4.

1) Pest Diagnostic Services

One of the greatest impediments to the development of IPM in the CA/P region is the lack of easily accessible pest diagnostic services to identify causal organisms and damage symptoms. The project will fund creation of a regional pest diagnostic service center at CATIE to fill this gap. By utilizing existing laboratories in the participating countries, the project will also establish a network of pest diagnostic centers in the region (minimum of one center in each participating country) to be linked to the Regional Pest Diagnostic Center at CATIE. This network will facilitate the flow of information and significantly expand the capacity in the region for identifying damage causing pests.

The regional center will be staffed by the project funded IPM specialists. These specialists will provide a centralized source of diagnostic expertise capable of responding to requests from national institutions. Specific tasks of the regional center include:

TABLE 4

SUMMARY OF TECHNICAL COOPERATION COMPONENT

Activity	Outputs
1. Pest Diagnostic Services	. Comprehensive region-wide pest specimen collection assembled and pest identification and diagnostic services made available in all 5 CA/P countries to national and regional institutions, farmers, and agribusinesses. . Pest diagnostic centers in each of the 5 CA/P countries.
2. Regional IPM Information Service Center	. Comprehensive IPM information base developed and made available to national and regional institutions and agribusinesses. . Photocopy services and library loans/referral services made available by CATIE to CA/P institutions. . Publication and distribution of 20 quarterly newsletters in IPM and five annual IPM Project Reports
3. Technical Assistance in IPM	. 25 consultancies in IPM provided by short-term advisors. . Periodic short-term technical assistance in IPM provided by project staff to national institutions.

- Conducting initial and follow-up training for national diagnosticians and assist in organizing the network of national centers.

- Establishing and maintaining reference collections for weeds, insects, plant pathogens, nematodes, and other pests of principal crops in the region.

- Developing a computerized catalog of pest species of principal crops in the CA/P region by taxonomic criteria (class, order, family, genus and species, and common names in Spanish), by crop and cropping systems, and by country.

- Providing pest diagnostic keys, descriptions, illustrations, and training aids.

- Contributing to the regional project newsletter (see discussion under regional IPM information service center below).

- Cooperating with crop loss assessment research efforts by providing information on crop pest incidence by geographic area or cropping systems.

- Assisting in project training programs.

- Establishing and maintaining linkages with key pest diagnostic services in other areas of the world.

The national pest diagnostic centers, with assistance from the regional center at CATIE, will develop the capacity to diagnose common or simple pest problems. The centers will also serve as the principal link to individuals at the national level involved in pest management, such as extension and agribusiness personnel, and will offer limited training in pest identification and diagnosis for these individuals. To facilitate cataloging of pests on a regional basis, the national centers will provide CATIE with regular reports on the incidence of key crop pests, new pests identified, etc.

2) Regional IPM Information Service Center

The project will establish a Regional IPM Information Service Center at CATIE which will be linked to existing infrastructure at CATIE such as the Orton Memorial Library which is one of Latin America's most complete sources of information on tropical agriculture. The library also cooperates with agricultural documentation centers throughout the CA/P region.

Activities to be coordinated by the Center include:

- The Development of a Computerized IPM information base containing:

  - Bibliographic citations of the most relevant literature on IPM in the CA/P region.

  - A listing of IPM practices available for given crop/pest situations.

  - Registration information on pesticides for use on crops in the CA/P region.

  - A catalog of pest species and principal crops in the region.

  - A listing of international research centers, commercial library services, universities, and private organizations that provide IPM information.

  - The names and addresses of IPM, crop protection, and pesticide management workers in the CA/P region (identified according to discipline, speciality within discipline, and crop expertise).

- The provision of information search and referral service That will assist national technicians and institutions, teachers, private sector groups, and others access information requested on IPM topics. The computerized IPM information base will be used to facilitate searches. One important aspect of the service will be to identify sources of information at international research centers and private organizations.

- The provision of low cost photocopy services and library loans.

- The publication and distribution of a quarterly newsletter on IPM. The newsletter will be distributed to individuals and institutions involved in IPM and related fields in the region. The newsletter will be an important mechanism for strengthening communication among IPM workers in the region, and will cover a range of topics, including:

- New publications and techniques in IPM, and how to receive them.
- New developments in IPM research.
- Announcements of meetings, short-courses, etc., to be held in the region.
- Progress reports on development of the IPM regional project.
- Employment opportunities and needs.
- Change in status of pesticide registration or new pesticide products.
- Records of new pest introductions or outbreaks.

- Training and technical assistance in literature searching and documentation. The Center will cooperate with national libraries and research and extension institutions by providing limited short-term training and technical assistance, as required, to increase national institutions' capacity in IPM information management.

3) Technical Assistance

Under this activity, project staff supplemented by short-term consultants will provide technical assistance on specific tasks required to facilitate regional and national IPM program development, implementation, and evaluation. Assistance will be initiated in response to specific requests which, typically, will be received by the country coordinator and passed on to the IPM team at CATIE. Staff of national institutions interviewed during the development of the project identified the following types of short-term assistance they will require:

- Assistance in analyzing and interpreting data collected in the course of pest management research efforts at national and private institutions.
- Assistance in analyzing sociological factors affecting transfer of IPM technology.
- Assistance in developing project proposals in IPM for submission to international funding organizations.

- Assistance in establishing pest reference collections.
- Advice on appropriate training materials for nationally or privately organized IPM or pesticide management training sessions or academic curricula.
- Consultation on specific pesticide regulatory policy analyses requested by governments.
- Technical assistance in diagnosing a new, unidentified, or atypical pest problem threatening the region.
- Assistance in design, development, and assembly of materials for use in extending IPM information to farmers.

The provision of technical assistance by the project staff will be complemented by approximately 25 short-term consultancies (1-4 weeks) over the life of the project.

b. Implementation

The provision of services under this component will be coordinated by the entire IPM team with the plant pathologist having primary responsibility for pest diagnostic services and the service center (including the newsletter) coordinated by the information specialist. All members of the team will provide technical assistance as appropriate. In those cases where project staff do not have the technical proficiency to provide requested services, specialized short-term assistance will be obtained from qualified consultants. The country coordinators will assist in identifying the need for and requesting services.

Initially, the project will cover the entire costs of some of the services (technical assistance, the newsletter, pest diagnosis) and, for others, establish a fee structure under which a portion of the costs will be covered by those receiving the services (literature searches and publications). As CATIE gains experience in providing services and demonstrates that the services are cost effective, a more appropriate fee structure will be established so that all costs are covered, thereby permitting this activity to become self-sustaining. Toward this end, a gradual increase in fees is planned over the life of the project. The extent of the increases will be evaluated annually based on the performance over the year.

c. Inputs

In addition to the staff requirements discussed elsewhere, the project will fund the cost of constructing a pest diagnostic center and providing the basic laboratory equipment and supplies needed by the center. The project will also fund a limited amount of computer hardware and compatible support equipment to expand the storage capacity of the existing main computer at CATIE. The cost of specialized short-term consultancies to supplement the technical assistance provided by project personnel will be funded by the project. CATIE's contribution to this component will be financial support for the diagnostic and information centers which will come primarily from fees charged for services in the later years of the project.

IV. COST ESTIMATES AND FINANCIAL PLAN

The proposed budget for the project is $7.5 million of which ROCAP's contribution will total $6.75 million (90%) and CATIE's $0.75 million (10%) Table 5 contains a summary of the project budget showing each component and the funding source.

Project funding will cover activities planned over the implementation period of five years from January, 1985 through December, 1989. Table 6 shows the expenditure schedules for the ROCAP contributions over the five years implementation period of the project by major component and by year. Further detail on the budget with detailed explanations of calculations is found in Annex I-K.

Table 5

FINANCIAL PLAN PROJECTED COSTS
(US$000)

Project Element	ROCAP	CATIE	TOTAL
Personnel	2,741	588	3,329
Equipment & Materials	441	87	528
Training	946	50	996
Construction	90	--	90
Travel & Per Diem	400	--	400
Evaluation	90	--	90
Printing and Publication	50	25	75
Inflation + Contingencies	765	--	765
Overhead	1,227	--	1,227
TOTAL	6,750 1/	750	7,500

1/ The budget assumes that activities will be carried out in Guatemala beginning in FY 1985. If Guatemala's participation is delayed beyond that point, the budget will be reviewed and revised accordingly.

Table 6

PROJECTED EXPENDITURE OF
AID-ROCAP CONTRIBUTION
($000)

ELEMENT	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	TOTAL
Personnel	265	724	804	671	277	2,741
Equipment & Materials	222	60	75	44	40	441
Training	33	199	255	227	232	946
Construction	90	--	--	--	--	90
Travel & Per Diem	30	100	90	90	90	400
Evaluation	--	45	--	--	45	90
Printing and Publication	2	15	9	9	15	50
Inflation + Contingencies	96	171	185	168	145	765
Overhead	164	292	315	269	187	1,227
TOTAL	902	1,606	1,733	1,478	1,031	6,750

V. SUMMARY PROJECT ANALYSES

The following summarizes the specific analyses conducted in designing the project. The complete analyses, appearing in Annexes I-F to I-J, were developed by the project design team following consultations throughout the region during the period January 22 - March 9, 1984 (see Annex II-C for a list of the persons contacted).

A. Technical Analysis

The mix of project activities was carefully considered based on conditions in the region as well as experience brought by the design team from other IPM projects in the world. This analysis reviews the technical factors in determining the proposed design and the approach selected for its implementation.

Indepth discussions throughout the region with national government officials and technicians, private sector groups, and USAIDs, led ROCAP, and the experts on the design team to the conclusion that:

- low agricultural productivity is a common problem which is receiving priority attention throughout the region;

- there is a technically qualified regional institution committed to working with national counterparts on the problem which has the potential to maintain a central core staff over the long-term;

- as designed, the project does not duplicate other IPM projects in the region, rather it consciously attempts to maximize support for them; and

- a regional effort is feasible and cost effective.

Interviews and visits conducted by the design team as part of intensive review and project design identified a high level of interest at the national level for participating in the project.

The project will not involve new or complicated technologies. Research activities are designed based on CATIE's experience under the Small Farm Production Systems project, and they carefully consider the socioeconomic characteristics of the small farmer. Project activities will also be facilitated because a large portion of small farmers already practice traditional production methods which incorporate IPM techniques (i.e., cultural practices such as polyculture, minimum or no-till practices, fallow lands, and little or no fertilizer or chemical pesticides). The project will

respect and preserve those practices which are sound and improve those which are not.

The approach selected for the project is to provide a limited but integrated set of services to the target audience of public and private sector individuals and institutions involved in agricultural production that will lead to strengthening the capacity in the region for implementing IPM. Research activities will provide technologies adapted to the Central American context. A major training effort (that will draw on research results) is oriented toward professional and technical personnel and will provide opportunities for graduate degrees as well as in-service training. Services will be provided to meet short-term technical assistance needs for ongoing projects and for identifying new pest problems. Training materials and data base facilities at CATIE will support the project's efforts to strengthen IPM practices in the region.

The central staff to be located at CATIE will be complemented by country coordinators who will serve as the link between the regionally provided services and the needs at the country level for research, training and technical services. This approach has, through other CATIE regional projects, proven to be both effective and critical to the success of the technology transfer and institution building process.

As designed, therefore, the project takes into consideration known technological and institutional constraints and seeks to improve and increase the capability to undertake IPM activities throughout the region. After reviewing the above factors, the project committee has determined that the proposed design is technically responsive to the problem identified and that no technical constraints exist to inhibit successful project implementation.

B. Institutional Analysis*

The proposed project will be implemented by CATIE's Department of Plant Production (PPD), under the direction of the IPM Project Manager (see Annex I-G for full details). This Department

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*At AID/W's request, ROCAP financed a detailed institutional assessment of CATIE which was carried out by Coopers & Lybrand in November 1983. The C&L report concluded that CATIE "is perceived as an effective implementor of projects by sponsoring agencies as well as well as by the national government counterparts with which it carries out most of its project." The C&L report was presented to AID/W in February, 1984, and the reader is referred to that document for more detail on the institutional soundness of CATIE.

has performed well in implementing the small farm production systems project and, through training in the methodologies developed, has significantly influenced the orientation of agricultural research in the CA/P region. CATIE views IPM as an integral part of the farming systems approach and, with its previous experience, has the institutional capacity to develop and implement the regional IPM project.

The current size and composition of the PPD staff, however, is insufficient to implement the proposed project. Recruitment of additional professional staff, plus secretarial and support staff, is essential and is planned by the project to ensure effective and credible project implementation. Some of this staff will be retained as permanent CATIE employees after project termination, because of an expected continuing demand for CATIE's services in IPM created through project activities.

CATIE is well positioned to implement the proposed project for several reasons. It is in Costa Rica, a country free of many socio-political problems now affecting much of the region. Further, its regional character allows it to function relatively free of the economic, social, and political constraints that usually affect national institutions, and assures stability and continuity that national and bilateral projects often lack. Also, the Center's well established infrastructure and capacity for research, training, and information management, as well as its linkages with other regional institutions and institutions in each CA/P country, provide a unique capacity for regional coordination.

These linkages make it possible to collaborate with a variety of institutions which are involved in crop protection activities. the project design team contacted several of these institutions during intensive review and discussed specific areas of potential collaboration. These institutions, which ranged from ministries and national universities to private industry and regional organizations such as SIECA and OIRSA, all indicated a strong desire to work with CATIE In coordinating crop protection activities.

C. Economic Analysis

In assessing the economic feasibility of the project, a detailed analysis was conducted taking into consideration the direct impact on productivity through the adoption of IPM practices and the long-term benefits expected to accrue from the training activities (see Annex I-H). Two case studies which support the conclusions reached are reviewed in the detailed analysis.

The magnitude of expected benefits of this project is derived from the great economic importance of pests and pest control in CA/P. A conservative estimate of the economically quantifiable impacts of agricultural pests and pest control in CA/P is an annual cost of from $650 to $800 million. These impacts are a result of: the large in-field and storage losses attributed to inadequately managed or uncontrolled pest populations; the often excessive production costs associated with efforts to control pests attributable to use of pesticides in agriculture. Not included in the $650 - $800 million estimate are the important impacts on the human health and the environmental costs of improper pesticide use, and reductions in foreign exchange earnings resulting both from the requirement for imports of pesticides into the region and the restrictions by developed countries on imports of products from the region which have been contaminated by pesticides.

The IPM project's extended benefits are expected to yield greater than a 15% internal rate of return to total project investments.

Approximately $1 million will be returned in the form of increased wage and employment opportunities for professionals trained through support provided by the project. The remainder will accrue in the form of regional impacts assumed to result from the translation of project-developed institutional capabilities, knowledge, skills, and technology into improved agricultural practices.

Achievement of a 15% return is equal to any one, or some combination, of the following minimal targets:

- a 8.25% average regional decrease in basic grains pre- and post-harvest losses to pests, spread over 5 years following project termination (feasible given IPM results in other areas of the world); <u>or</u>

- a 1.4% average regional increase in small farms' net returns to basic grain production, spread over 5 years following project termination, <u>or</u>

- a 10% average regional decrease in the value of pesticides used in cash crop production, spread over 5 years following project termination.

Since each of the above represents a very modest accomplishment that is likely to be exceeded by actual impacts, it is concluded that the extended economic benefits of the project will far outweigh its costs.

The most beneficial impacts are not expected to occur within the project funding period. Rather, the project will build the institutional capabilities that are a necessary prerequisite for these changes to occur.

In addition to the benefits specified above, the project's technical cooperation component will achieve significant economies of scale. This is demonstrated by a cost-effectiveness comparison between establishment of a regional IPM data base/information system and separate, independent national systems. Fixed costs per user are estimated to be 95 percent lower for a centralized regional data base/information system.

While improved pest management will neither recapture all crop losses to pests nor eliminate the private and social costs of pest control, there is obvious untapped potential for improvement in CA/P. If it is assumed that the IPM training and research provided through this project will be applied in specific cases at the national level, quantifiable increases in farmer net returns and measurable decreases in pesticide problems can be expected to be observed. This assumption is considered to be valid since project activities are focused on regional concerns and designed to promote the use of IPM.

D. Social Analysis

Although the purpose of the project is to strenghten the CA/P institutions' capability in IPM, the ultimate beneficiaries of all project activities will be the regions' farmers. The major means of diffusing project results to these beneficiaries is through the training and technical cooperation components of the project.

Diffusion of project results and other information on IPM, will be delivered through the IPM information service center. This information will be made available on a demand basis to institutions and organizations, as well as individuals, from both public and private sectors. The proposed training programs have been targeted at the various groups that are involved in the use of project results and, eventually, their widespread diffusion. This includes policy level officials in the national governments, technical personnel, private sector industries such as those involved in pesticide distribution, and future managers and teachers in crop protection.

The project will establish sound integrated pest management practices aimed at decreasing deleterious effects on pest organisms and pest control practices in major crop production systems in the CA/P region. Procedures for selecting small farm target populations

as collaborators have already been established by CATIE in the ROCAP-financed Small Farm Production Systems Project. These procedures assure maximum farmer participation in technology development, testing and training, and will be adopted by the IPM project. Consequently, all research results will incorporate small farmer concerns which will facilitate maximum diffusion of the improved technologies.

E. Financial Analysis

1. Financial and Administrative Viability and Capability of CATIE

As a non-profit organization, CATIE's objective is to match income with expenses while maintaining its ability to provide services to the region. Prior to 1981, CATIE continuously fell short of that objective and was often forced to operate through deficit financing. The result was a shaky financial picture which threatened the ability of the institution to function.

Beginning with the arrival of a new administration in 1981, CATIE placed top priority on improving its financial situation. A first step was to embark on an austerity program in which expenditures were reduced to a minimum while measures to control long-term costs more effectively were studied. In addition, ROCAP contracted with the local Price Waterhouse firm to conduct an exhaustive review of the financial and administrative mechanisms at CATIE. A series of recommendations made by Price Waterhouse have been instituted, and a new set of procedural manuals have been developed and accepted by CATIE. Also, CATIE now has an Administrator on the staff whose primary function is to oversee the financial operations of the institution.

Due to the policies instituted in 1981, CATIE's 1982 Statement of Income and Expenses shows an excess of income over expenses in 1981 and 1982, with the deficits from previous years completely eliminated (see Annex I-K, Financial Analysis, for details). This financial performance can be expected to continue in the future and become more fully institutionalized once the manuals developed by Price Waterhouse are put into use.

In addition to these efforts, the financial analysts of ROCAP's staff periodically visit CATIE to review matters related to the financial status of ROCAP projects as well as other financial matters which may arise. As a result, the Mission is completely current on the financial situation at CATIE and can state that CATIE has adequate accounting systems, sufficient administrative expertise and financial capability to undertake the proposed project.

In November, 1983 an independent financial and institutional assesment of CATIE was completed by Coopers & Lybrand in response to and AID/W request. The assessment found that CATIE's financial status is sound and that it is "financially viable on a long-term basis."

2. Budgetary Analysis

CATIE relies on quota payments from member countries ($250,000 per year), an annual contribution from IICA (currently $750,000 but projected to increase to over $1.0 million by 1985), and on contributions from the international community for the majority of its core budget used to meet basic operating expenses. In addition to these sources, CATIE generates income from the sale of crops produced on its commercial farm and from other assets such as rental of residences and seed bank sales. However, the farm income is not be heavily relied upon because a significant percentage of it consists of export crops (coffee and sugar), products for which world market prices fluctuate considerably, and which recently have been quite low.

As a consequence, therefore, CATIE does not have a fixed minimum, guaranteed annual core budget and must maintain its administrative expenses at the lowest possible level consistent with normal day to day operations. As part of its financial, accounting, and administrative reorganizations, CATIE has succeeded in its efforts to lower those costs.

Another area in which CATIE is focusing its efforts on improving the financial stability of the institution is in the charging and collecting of an overhead fee on projects and contracts which require administrative and logistic support. This is important for CATIE since, in 1982, approximately 67% of its total income came from contracts for project specific activities. In the past, most projects included only a small amount for such support, forcing CATIE to draw upon its core budget to provide it. In effect, CATIE was spending funds it did not have to support project activities, which was a major factor contributing to its financial difficulties.

At this time, CATIE is implementing the recommendation on overhead made by Price Waterhouse as part of its review of CATIE's financial and administrative mechanisms. In developing its recommendation, Price Waterhouse identified a series of factors to be considered in determining an appropriate overhead charge for new projects or contracts. Each factor (e.g., number of international and national personnel assigned, the system to be used for expense reimbursement, the number of countries where project activity will

take place, and purchasing activities) has a weighted value and, when added together, they provide the overhead rate required to cover the marginal cost to CATIE of undertaking the project or contract. After applying this system to the proposed project, an overhead of 30% of total project costs was calculated. While the 30% overhead represents a doubling of the rates charged under earlier ROCAP projects with CATIE, it has been developed in accordance with the system recommended by Price Waterhouse. The Mission's review of the calculation and assessment of the support services it will enable CATIE to provide to the project indicate that the overhead charge is appropriate.

Because of the importance of overhead charges to the long-term financial stability of the institution, the Mission intends to work closely with CATIE to assure that the Price Waterhouse recommendation is applied in all new projects and contracts. ROCAP believes that this type of positive action builds on sound financial principles and will permit CATIE to sustain its efforts to stabilize the institution's financial condition.

In summary, the recent positive actions taken by CATIE have contributed to a sharp turnaround in its financial condition. Its budget is now built on sound financial principles and appropriate measures are in place to assure that the trends initiated over the past two years are continued.

3. Replicability

For this project, replicability will be measured by CATIE's ability to maintain a permanent staff of IPM specialists once the project has ended. At that time, a sufficient core of technicians from the region will have been trained and will be able to replace the international experts funded by the project. Also, it is expected that continued research requirements will be handled primarily through thesis work of M.S. students. Consequently, future personnel costs to CATIE will be less than the costs associated with this project. In addition, if there is a continuing role for the country coordinators, it is expected that the countries will pick up the respective costs.

As the project staff gains increased experience and expertise, it is planned that CATIE will charge fees consistent with the actual cost of the services they provide -- be it to national institutions, private sector groups or other organizations which request assistance. Initially, only nominal fees will be charged for some services since it will be necessary to demonstrate, first, that the services are essential to the development plans of the region (in a sense this will be part of the awareness building

program), second, that the potential savings warrant paying the costs of the services and, third, that CATIE can provide them on a timely and effective basis.

Charging for services is not a new concept for the regional institutions. CATIE is generating income through services provided by its Wildlands program sufficient to maintain a staff of two professionals for the program. INCAE has been increasing the number and scope of the seminars it provides because of the demand for assistance and because the seminars generate a considerable income for the institution. Under the Regional Energy Efficiency project, ICAITI will eventually charge the full cost for its industrial auditing services and, although no direct experience is available yet, preliminary indications are that clients are willing to pay for the services they can receive from the project.

At this time, a specific mechanism which CATIE will install to generate income from IPM activities has not been developed. It is planned that the mechanism will evolve over the life of the project and will be devised with the assistance of the senior staff who, in large part, will be responsible for generating much of the demand that should result in income generating opportunities for CATIE.

4. Method of Implementation and Financing

The direct reimbursement financing method will be used for all project expenditures. This method has been employed in all previous projects with CATIE and is judged to provide good internal control with low vulnerability. Given the regional nature of the project and that CATIE operates in many countries in the region, reimbursement will be made in U.S. Dollars to a separate bank account which CATIE will maintain for the project in the United States.

Based upon periodic assesments of the accounting and internal control system of CATIE, by both independent auditors and ROCAP financial analysts, a Certified Summary Disbursing Report, accompanied by a SF-1034 to process reimbursements to the institution, is accepted by ROCAP's Controller's Office to document project expenditures. Post payment reviews are performed by ROCAP's Financial Analysts based on randomly selected samples of vouchers which are large enough to provide reasonable assurance that the voucher approval is correct and well supported by appropriate documentation.

As a non-profit institution with a limited internal cash flow available to apply to project activities, advances are

required to assure adequate implementation of project activities. The amount of each advance is based upon Treasury and AID guidelines and is only for immediate disbursing needs. This procedure is currently used under other ROCAP-financed projects with CATIE, and experience has shown that it is effective and can be carefully controlled.

5. Audit Coverage

As a regional institution with funding received from many sources, CATIE policy requires an independent annual audit to document its financial status. Price Waterhouse has performed these audits in the past and submits copies to ROCAP upon completion. Included in the 1982 audit, at ROCAP's request, was a detailed review of ROCAP project costs. This information is to be included in all future annual audits. Additionally, ROCAP financial analysts perform periodic reviews of CATIE's internal control and voucher approval/processing system. In light of these procedures, it has been determined that there is no need for expanded audit coverage or tightened internal financial controls; therefore, no project funds have been budgeted for additional audits.

F. Environmental Assessment of Pesticide Use

The use of some pesticides will be required for the project to meet its objectives. Some of the research and demonstrations carried out on farmers fields will involve the use of these chemicals as an element of a total IPM program. This work will be oriented towards determining the most appropriate use of pesticides in IPM programs while minimizing potential hazards to human health and environment. Promising new application and safety equipment will be tested and demonstrated when found to be effective.

Project use of pesticides will be carried out under carefully monitored conditions. The project will not purchase pesticides for distribution to farmers. The project will sponsor training on correct use of pesticides and their integration into IPM programs that may involve participation of selected farmers. Pesticide applicators (small hand-held sprayers), safety equipment, and protective clothing will be purchased with project funds and issued to collaborating farmers as well as project personnel.

Annex I-J presents the proposed use of pesticides in det... and sets forth AID's required procedures for pesticide use (part 216 of Regulation 16). To ensure compliance with these procedures, CATIE will designate the entomologist on the IPM Team as pesticide coordinator. This individual will supervise pesticide use in the project and assure compliance with AID procedures. The project's

training component includes several major initiatives in pesticide management which will be directed at a wide audience.

During project evaluation, pesticide use will be reviewed and recommendations made concerning needed changes in product use and application procedure.

Based on the analysis of proposed pesticide use and the conditions under which they will be employed, a negative determination has been recommended by the IEE.

VI. IMPLEMENTATION ARRANGEMENTS

A. Administrative Arrangements

1. Role of CATIE

Figure 1 illustrates the management and coordination arrangement planned for the project at CATIE.

CATIE's plant production department will have overall responsibility for project implementation. The IPM project manager, who will report to the Head of PPD, will administer the project, supervise all staff assembled for the project, and ensure that the IPM project is properly integrated into PPD's overall program. The Project Manager will also serve as the contact for ROCAP staff on all implementation matters.

The members of the IPM team at CATIE will jointly hold responsibility for preparing detailed work plans and assuring that appropriate linkages exist among project components and between regional and nationally-based efforts. Job descriptions and duties of each of these individuals are provided in Annex II-A.

Each of the participating CA/P countries will have an IPM country Coordinator to work full-time on the project with responsibility for coordinating and implementing all in-country project research, training, and technical cooperation. The IPM Program Coordinator will organize a national IPM work group made up of representatives from national and private sector institutions or groups with a specific interest in crop protection and the activities proposed by the project.

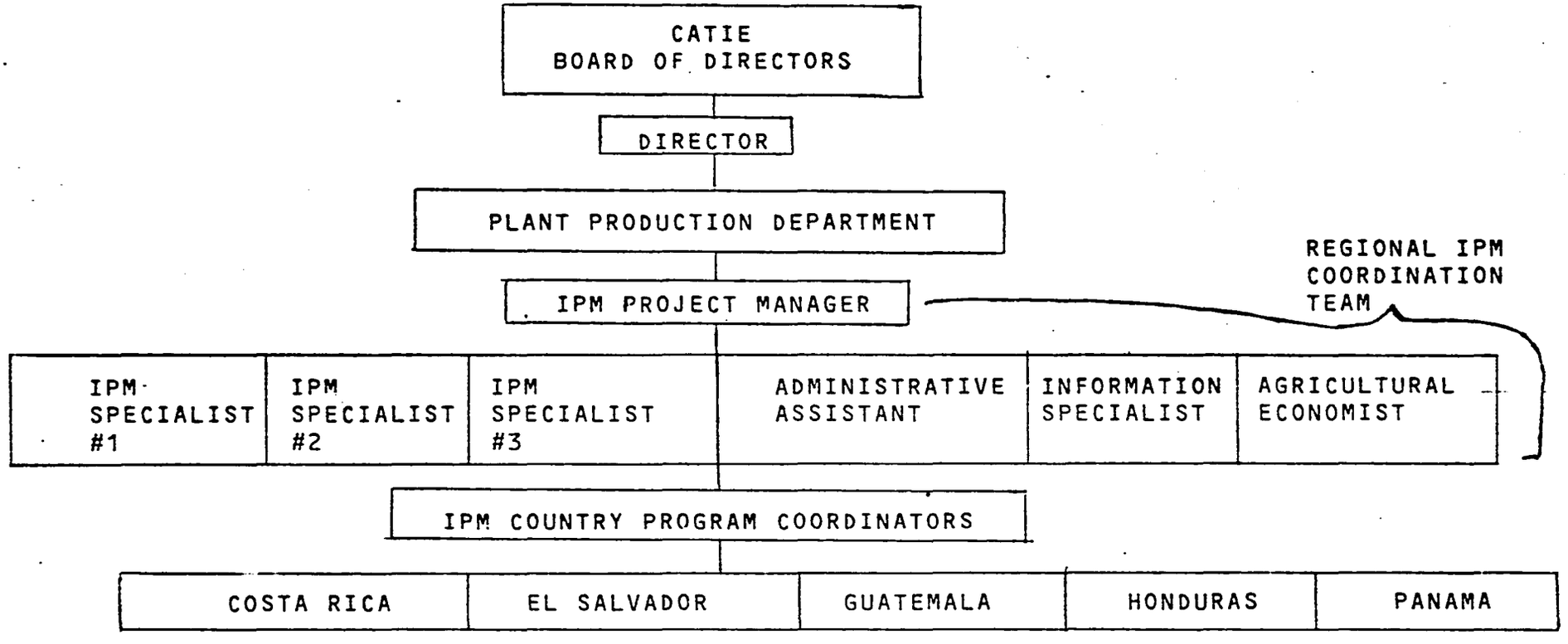
The Project Manager will supervise the work of the five IPM country coordinators. Their relationship will be a key element in ensuring that the project provides effective outreach to national institutions.

2. Role of ROCAP

ROCAP's Agricultural Development Office will have primary responsibility for managing the project. The Regional Pest Management Specialist assigned to that office will serve as the project technical coordinator with day to day responsibility for monitoring implementation status.

Within ROCAP, an implementation committee has been established with representatives from the Program and Project Development and Controller's Office. As needed, they will assist the ADO and RPMS in addressing any implementation issues that may arise.

FIGURE 1 - REGIONAL IPM PROJECT MANAGEMENT AND COORDINATION SCHEME



From its experience with other ROCAP projects, CATIE is familiar with the general administrative requirements, such as progress reports and financial controls, which ROCAP establishes, and has demonstrated its capacity to comply with them. In light of this experience, no administrative problems are anticipated.

B. Implementation Plan

The schedule of all major events as they are currently planned is contained in Annex I-L. This schedule reflects the combined judgment of CATIE and ROCAP as to when these events should occur within the context of the general strategy of first getting staff on board and providing them with necessary preliminary training, of carrying out crop loss assessments to define research priorities and of having generated some preliminary results before mounting a major training effort at the national level.

Regular monitoring of project progress will assure early recognition of unanticipated problems and areas where modifications are needed. This will be particularly important in the early stages of the project. Toward this end, project staff will prepare regular progress reports covering activities and accomplishments, factors affecting implementation, financial status and, based on these, planned activities during the next reporting period. Annually, the project staff will prepare new work plans which will become the basis for amending the implementation plan.

C. Evaluation Plan

A total of four formal evaluations -- two conducted jointly by ROCAP and CATIE and two by outside consultants -- will be conducted during critical stages of project implementation.

1. 18-month Evaluation

At approximately the 18th month of project implementation, an outside consultant team selected jointly by ROCAP and CATIE will conduct an evaluation to determine if detailed project plans are adequate to achieve project objectives. By this stage of the project, all principal project staff will have been hired, trained, and begun to perform their duties. The tasks of the evaluation team will be to review specific implementation plans in consultation with the regional IPM staff and the country coordinators, and to develop a set of recommendations for possible early changes in project direction.

2. CATIE-ROCAP Evaluations

Two formal evaluations involving ROCAP and CATIE staff will be conducted to examine the progress of activities under each project component, the appropriateness of the training being provided, the quality of communications developed, the effectiveness of the National IPM Work Groups, the extent to which national institutions are capitalizing on CATIE's technical services capabilities, and the management of the project. These evaluations are scheduled to occur in the 26th and 42nd months of project implementation.

The first of these evaluations will focus on project planning, coordination, and staff performance. Evaluators will review the recommendations of the 18-month evaluation team in light of progress achieved in adopting those recommendations, and further evaluate early progress in outreach and research aspects of the project. The evaluation report will include assessments of:

- observed utilization rates for diagnostic, information, and technical services.

- effect of pesticide management training on pesticide use patterns in the region, and project use of pesticides.

- degree of involvement of national and private institutions in the project, and the level of their satisfaction with project progress.

- appropriateness of research activities initiated.

- Progress made by CATIE toward preparing to begin paying the salary costs of the IPM specialists and generating resources to maintain IPM services after the project ends.

The 26-month evaluation will include recommendations for improving performance in these areas.

The second CATIE-ROCAP evaluation, at month 42, will focus on project outputs, technology transfer, CATIE's ability to provide its financial contribution to the project and the adequacy of resources being generated to maintain an IPM capacity at CATIE beyond the formal project period (e.g., data base operating and self-sufficient, diagnostic center established and generating income, maintaining a minimum level of research, and an IPM specialty incorporated into the M.S. program). Factors to be assessed at this stage will include:

- Quantity, quality, distribution and accessibility of project reports, professional publications and training materials.

- Extent to and effectiveness with which research validation results have been communicated to regional extension agents and pest control practitioners.

- The impact on CA/P small farmers of extended IPM information and technology.

- Observed willingness of national and private institutions to purchase services provided with project support.

The evaluation report will include recommendations regarding the project components and activities that will require special, concentrated effort during the final year of the project.

3. Final Evaluation

A final evaluation will be conducted toward the end of the project. It will be carried out by an outside consultant team selected jointly by ROCAP and CATIE and will focus on an assessment of the overall success of the project. The team will visit each CA/P country to examine country level developments, problems and accomplishments, as well as regional centers of project activity, and also will obtain information on project success from the perspective of the target groups for project benefits. The final evaluation report will include:

- overall assessment of the degree to which original objectives have been met.

- estimation of the value of benefits resulting from the project.

- identification of principal factors leading to project successes and failures.

- assessment of the likelihood that project accomplishments will be sustained.

- extrapolation of findings in the form of recommendations regarding future development of regional IPM projects.

- assessment of CATIE's capacity to continue an IPM program, including research, training and technical assistance.

D. Procurement Plan

CATIE will serve as its own agent for the procurement of goods and services required for the project. The CATIE procurement procedures have been reviewed by ROCAP on various occasions and have been found to be consistent with AID regulations. From its experience with previous ROCAP projects, CATIE is familiar with AID procurement regulations, and has demonstrated that it has the capacity to carry out the planned procurement activities.

1. Technical Services

Long and short-term services will be procured for the project. To satisfy these needs, CATIE will contract individually for each position. This is its normal practice and offers a large pool of potential candidates from which to draw.

It may be necessary to recruit some of the senior project staff from outside CA/P because few individuals with sufficient expertise are available in the region. It is expected that of the project funded positions some, but perhaps not all, will be filled from the U.S. If the project must recruit certain members of the senior staff from other LAC or Code 941 countries, a request for a 941 source/origin waiver will be submitted to AID/W.

To recruit for these staff positions, CATIE will place announcements in newspapers and technical publications; utilize contacts in national and international institutions; and contact the USAIDs to identify potential candidates. Scopes of work will be provided to all interested individuals. After reviewing each application, CATIE will hire the most qualified individual for each position.

2. Commodities

Project financed commodities will be purchased by CATIE following the guidance provided in Handbook 11. Most of the project commodities will be purchased in the United States. Some, however, may be bought locally in the CA/P region. The detailed Financial Plan (Annex I-K) contains a list of the commodities needed to support the research, training, and technical cooperation to be provided by the project. This includes computer equipment designed to upgrade and expand the data processing capacity at CATIE in order to meet the requirements of the project. M/SER/IRM will be asked to review and approve the specifications of this equipment prior to its procurement.

E. Waivers

It may not be possible to recruit all of the project staff from Central America/Panama and the U.S. If so, appropriate source/origin waivers for Code 941 procurement will be submitted to AID/W for approval.

F. Conditions, Covenants and Negotiating Status

1. Conditions Precedent to Disbursement

a. First Disbursement

The standard CPs to initial disbursement will apply, including the designation of official CATIE representatives and their authorized signatures.

b. Subsequent Disbursements

1) Prior to disbursement of funds for activities other than for hiring long-term personnel, CATIE will prepare and submit a detailed workplan for the first year of the project to ROCAP for approval.

2) Prior to disbursement for funds for activities in any of the participating countries, CATIE will execute letters of agreement with the primary agriculture institution of those countries, establishing working relationships between CATIE country coordinators and national institutions, and identifying national inputs to the project.

2. Covenants

a. Fees and Project Reflows

CATIE will covenant that all fees collected for services provided under the project will be used to finance costs related to the project.

b. Other Services

CATIE will covenant to provide appropriate housing for all international personnel funded under the project.

c. Project Coordination

CATIE will covenant to coordinate appropriate project activities with USAID missions in each country.

d. Work Plan and Budget

Prior to undertaking project activities each year after the first year of the project, CATIE will furnish, in form and substance satisfactory to AID, a consolidated work plan and budget for activities for that year.

3. Negotiating Status

The design of the proposed project has been developed in close consultation with CATIE. The design team spent over one month at CATIE working with CATIE staff on all planned activities and presented their final report and recommendations to CATIE management.

ROCAP believes that all issues have been discussed and resolved with CATIE during the design process. There should be no problems in negotiating the Grant Agreement which can be signed shortly after the project is authorized.

ACTION ROCP INFO AMB DCM AID ECON/10

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PP RUEHGT
DE RUFHC #3550/01 3270157
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UNCLAS STATE 333550

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CN: 49994
CHRG: ROCP
DIST: ROCP

AIDAC GUATEMALA FOR ROCAP

ACTION: PROGRAM
INFO: RURAL DEV
DIRECTOR
CONTROLLER
GENERAL DEV

E.O. 12356: N/A
TAGS:
SUBJECT: ROCAP INTEGRATED PEST MANAGEMENT PID

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MAIL ROOM
USAID/GUATEMALA

THE ROCAP INTEGRATED PEST MANAGEMENT (IPM) PID WAS REVIEWED AND APPROVED BY THE LAC BUREAU FRIDAY, OCTOBER 28, 1983. THE FOLLOWING COMMENTS AND GUIDANCE ARE PROVIDED TO ASSIST THE MISSION IN ITS INTENSIVE REVIEW AND IN THE PREPARATION OF THE PROJECT PAPER. WE UNDERSTAND THAT THE MISSION PLANS TO SUBMIT THE PROJECT PAPER FOR AID/W REVIEW AND APPROVAL IN MARCH 1984.

1. THE REGIONAL APPROACH.

SINCE THE SUBJECT PROJECT IS INTENDED TO COMPLEMENT ONGOING BILATERAL/NATIONAL EFFORTS, THE PP SHOULD INCLUDE A DETAILED DISCUSSION OF THE ADVANTAGES OF A REGIONAL VERSUS A NATIONAL APPROACH. THE CASE SHOULD BE MADE IN THE BACKGROUND SECTION AND EXPANDED IN THE APPROPRIATE ANALYSIS SECTIONS THAT THE CATIE APPROACH CONSTITUTES A COMPARATIVELY EFFECTIVE MEANS OF ESTABLISHING AND TRANSFERRING THE IPM APPROACH IN CENTRAL AMERICA.

THE ECONOMIC ANALYSIS IN PARTICULAR SHOULD DEMONSTRATE THAT THERE IS A SIGNIFICANT PROBLEM IN THE REGION, AND THAT THE POTENTIAL SAVINGS TO THE ECONOMIES OF THE REGION JUSTIFY THE EXPENDITURE OF AID FUNDS. THE ANALYSIS SHOULD DEMONSTRATE THROUGH ILLUSTRATIVE CASE STUDIES THAT CATIE'S ACTIVITIES AT A REGIONAL LEVEL ARE MORE COST EFFECTIVE OR ARE OTHERWISE MORE ECONOMICALLY EFFECTIVE THAN WOULD BE THE CASE WITH DIRECT SUPPORT TO SIMILAR ACTIVITIES AT THE NATIONAL LEVEL. THE GENERAL APPROACH IN CONSTRUCTING THE ILLUSTRATIVE CASE STUDIES SHOULD BE TO USE EXISTING DATA AND, IF NECESSARY, NEW SURVEYS IN ORDER TO QUANTIFY THE EXTENT OF THE EXISTING CROP/PEST PROBLEMS. THE ILLUSTRATIVE CASE STUDIES SHOULD ALSO EXAMINE THOSE DEFICIENCIES IN THE ANALYTIC, TECHNICAL AND ADMINISTRATIVE CAPABILITIES OF THE NATIONAL INSTITUTIONS WHICH MIGHT BE FILLED BY CATIE.

IN ADDITION TO THE CASE STUDIES THEMSELVES, THE PP SHOULD LAY OUT A METHODOLOGY TO BE EMPLOYED IN THE COURSE OF PROJECT IMPLEMENTATION WHICH WILL DETERMINE THE

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COMPARATIVE ADVANTAGES OF THE REGIONAL APPROACH OR A NATIONAL APPROACH FOR A SPECIFIC IPM PROGRAM. THE DESCRIPTION OF THE METHODOLOGY OR SYSTEM TO BE USED SHOULD PRESENT THE DECISION CRITERA WHICH WILL BE CONSIDERED IN EVALUATING A GIVEN IPM PROGRAM, DISCUSS HOW THEY WILL BE WEIGHED, AND IDENTIFY WHO WILL BE MAKING THE DECISIONS. FACTORS THAT SHOULD BE TAKEN INTO ACCOUNT, BOTH IN THE ILLUSTRATIVE CASE STUDIES AND IN THE DEVELOPMENT AND USE OF THE METHODOLOGY SHOULD INCLUDE: (1) WHETHER A GIVEN IPM PROBLEM EXISTS AS A REGIONAL PHENOMENON; (2) THE PRESENCE AND EFFECTIVENESS OF EXISTING TECHNICAL INSTITUTIONS; AND (3) THE PRESENCE OF EXISTING IPM PROGRAMS AND CROP LOSS ASSESSMENT SYSTEMS IN THE VARIOUS COUNTRIES.

2. PROJECT PRIORITIES.

GIVEN THE NATURE OF THE OBJECTIVES ENVISIONED FOR THE PROJECT AND THE LIMITED FUNDS AT HAND, THE PP WILL NEED TO MAKE A CLEAR STATEMENT OF THE INITIAL ACTIVITIES TO BE CARRIED OUT AND A JUSTIFICATION FOR THEIR PRIORITIZATION BASED-ON THE ANALYSES AND FACTORS MENTIONED IN THE FOREGOING SECTION. PRIORITIES SHOULD BE IDENTIFIED IN CLOSE COORDINATION WITH PERSONNEL FROM THE LAC BUREAU AND THE BUREAU OF SCIENCE AND TECHNOLOGY.

IN ESTABLISHING PRIORITIES AND EXAMINING THE REGIONAL APPROACH IN GENERAL, THE PROJECT DESIGN TEAM SHOULD INCLUDE AN AGRONOMIST WITH A BACKGROUND IN IPM ECONOMICS. THIS INDIVIDUAL CAN HELP IDENTIFY A PROJECT METHODOLOGY FOR CROP LOSS ASSESSMENT AND FOR THE ESTABLISHMENT OF ECONOMIC THRESHHOLDS FOR THE CROP PEST ASSOCIATIONS THAT ARE IDENTIFIED AS MOST SIGNIFICANT TO THE PROJECT OBJECTIVES OF THE NATIONAL INSTITUTIONS.-

SINCE THE ECONOMICS OF THE SUGGESTED APPROACH WILL REQUIRE CLOSE SCRUTINY, PARTICULARLY IN TERMS OF COMPARATIVE- - ANALYSIS AND THE SETTING OF PRIORITIES, THE DESIGN TEAM SHOLD ALSO INCLUDE AN ECONOMIST. THE LAC/DR ECONOMIST AND A S AND T AGRICULTURAL ECONOMIST WILL WORK WITH THE MISSION TO ESTABLISH A SCOPE OF WORK FOR THE DESIGN TEAM ECONOMIST TO BE CONTRACTED. --

3. ANALYSIS OF THE IMPLEMENTING INSTITUTION.

THE INSTITUTIONAL ANALYSIS OF CATIE TO BE DONE DURING NOVEMBER AND DECEMBER 1985 SHOULD BE TAKEN INTO ACCOUNT IW THE DESIGN OF THE PROJECT. THE ANALYSIS-SHOULD ADDRESS THE FOLLOWING QUESTIONS THAT WERE RAISED DURING THE PID REVIEW: (1) CATIE'S RELATIVE INSTITUTIONAL CAPABILITIES AND WEAKNESSES BOTH IN GENERAL AND AS REGARDS - - IMPLEMENTATION OF THE SUBJECT PROJECT, AND HOW MIGHT THE

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WEAKNESSES BE REMEDIED; AND (2) AN EXAMINATION OF CATIE'S OVERHEAD CHARGES IN ORDER TO DETERMINE A REASONABLE RATE FOR USE IN DEVELOPING THE PROJECT BUDGET. - -- -

4. PROJECT SUSTAINABILITY.

AID SUPPORTS THE DEVELOPMENT OF CATIE AS AN INSTITUTION WITH THE EXPECTATION THAT IT WILL DEVELOP THE CAPABILITY TO MANAGE RECURRENT COSTS. THE PP SHOULD LAY OUT IN-DETAIL THAT CATIE WILL BUDGET ITS OWN FUNDS TO COVER, IN A PHASED-IN FASHION, RECURRENT COSTS SUCH ASLOCAL STAFF SALARIES THAT WILL CONTINUE AFTER THE AIDFUNDING OR THE PROJECT ENDS. THE PROJECT DESIGN TEAM SHOULD DETERMINE - WHAT CONTINUING RELATIONSHIPS SHOULD EXIST BETWEEN AID-AND CATIE REGARDING IPM ACTIVITIES, AND SHOULD EXAMINE CATIE'S STRATEGY FOR CARRYING ON THE ACTIVITIES PROPOSED IN THE-PP AFTER-THE PROJECT TERMINATES. FINALLY, THE PP SHOULD DISCUSS CATIE'S OVERALL POLICY STRATEGY AND CONSIDER WHAT IMPROVEMENTS IF ANY MIGHT BE INDICATED THAT WOULD BE CONSISTENT WITH THE DECISIONS AND ;RECOMMENDATIONS FLOWING FROM THE INSTITUTIONAL ANALYSIS NOW UNDERWAY. -

5. HEALTH AND ENVIRONMENTAL CONCERNS.

IN PREPARING THE PP PARTICULAR ATTENTION SHOULD BE PAID TO HEALTH AND ENVIRONMENTAL CONCERNS, AND TO AID REGULATIONS IN HANDBOOK 3, APPENDIX 4B, REGARDING THE USE OF PESTICIDES. DUE TO THE MAGNITUDE AND SEVERITY OF DISEASES SUCH AS MALARIA AND DENGUE FEVER IN CENTRAL AMERICA THAT ARE RELATED TO PESTICIDE MISUSE AND OTHER IPM PROBLEMS, THE MISSION SHOULD CONSIDER THE FEASIBILITY OF INCLUDING PUBLIC HEALTH-RELATED TRAINING ACTIVITIES AND DISCUSS HOW THEY MIGHT BE CARRIED OUT WITHIN THIS PROJECT. SUGGESTED TOPICS FOR PUBLIC HEALTH TRAINING PROGRAMS INCLUDE: (1) THE USE OFIPM TECHNIQUES IN THE CONTROL OF DISEASE VECTORS IN WAYS THAT DO NOT JEOPARDIZE THE SUCCESSFUL USE OF IPM IN THE AGRICULTURAL SECTOR; AND (2) THE USE OF IPM TECHNIQUES IN THE AGRICULTURAL SECTOR IN SUCH A WAY THAT DISEASE VECTOR CONTROL IS NOT JEOPARDIZED.

THE INITIAL ENVIRONMENTAL EXAMINATION HAS NOT YET BEEN APPROVED BECAUSE THE PID DID NOT INCLUDE A PESTICIDE RISK/BENEFIT ANALYSIS. EVEN THOUGH THIS IS AN ENVIRONMENTAL PROJECT AND IS EXPECTED TO BE BENEFICIAL, IT DOES NOT FIT THE CRITERIA OF REGULATION 16'S RESEARCH EXEMPTION. PESTICIDES ARE AN IMPORTANT PART OF IPM AND AN INITIAL LISTING OF THE TYPES TO BE USED CAN BE DEVELOPED PRIOR TO THE PROJECT START. THE REQUIRED ANALYSIS SHOULD BE COMPLETED DURING PROJECT DESIGN SO THAT THE IEE CAN BE APPROVED AT THE PP REVIEW.

6. PROJECT FUNDING.

PROJECT PAPER DEVELOPMENT WAS APPROVED AT THE DOLS 5 MILLION GRANT LEVEL. HOWEVER, SINCE IPM PROGRAMS ARE BY THEIR NATURE FLUID AND DYNAMIC, REQUIRING CONSTANT REVIEW AND REDEFINITION OF PROJECT PRIORITIES AND RESOURCE NEEDS, FUNDING REQUIREMENTS PROJECTED DURING PROJECT DESIGN MAY

PROVE TO BE INADEQUATE. FREQUENT PROJECT MONITORING AND EVALUATION WILL THEREFORE BE NECESSARY TO ASSESS AND POSSIBLY ADJUST PROJECT FUNDING. THE DAEC RECOMMENDED THAT THE EVALUATION PLAN IN THE PROJECT PAPER INCLUDE AN ANNUAL ASSESSMENT OF THIS ASPECT.

7. PROJECT STAFFING.

PROJECT STAFFING SHOULD BE CLOSELY COORDINATED WITH THE CONSORTIUM FOR INTEGRATED CROP PROTECTION (CICP), REPRESENTING THIRTEEN U.S. UNIVERSITIES, WITH OBVIOUS

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PREDOMINANT CAPABILITY IN IPM. THROUGH A CATIE CONTRACT OR ROCAP, THE PROJECT SHOULD ESTABLISH A CLOSE FORMAL RELATIONSHIP WITH CICP THROUGHOUT THE LIFE OF PROJECT.

8. PRIVATE SECTOR COORDINATION.

DURING THE PREPARATION OF THE PP, THE PROJECT COMMITTEE SHOULD INVESTIGATE CLOSELY THE CAPABILITIES AND INTEREST OF THE PRIVATE SECTOR IN PARTICIPATING IN THE PROJECT. THE PP SHOULD UNDERTAKE A SPECIAL ANALYSIS OF THE OPTIONS FOR PRIVATE SECTOR PARTICIPATION IN THE PROJECT, INCLUDING AN INVESTIGATION OF WHAT ADAPTIVE RESEARCH AND EXTENSION CAN BE UNDERTAKEN IN COORDINATION BETWEEN CATIE AND THE PRODUCER ASSOCIATIONS, AGRIBUSINESSES, SUPPLIERS AND MARKETERS. IN THE INSTITUTIONAL ANALYSIS OF CATIE WHICH IS NOW UNDERWAY, A SIMILAR INVESTIGATION SHOULD BE CARRIED OUT TO ASSESS WHETHER A CLOSE RELATIONSHIP CAN BE DEVELOPED BETWEEN CATIE AND THE PRIVATE SECTOR.

9. PROJECT ACTIVITIES IN NICARAGUA.

AT THE APPROPRIATE STAGES OF PROJECT DESIGN, THE MISSION SHOULD CONSULT WITH GC/LAC REGARDING THE EXTENT OF POSSIBLE INVOLVEMENT OF SOME ASPECTS OF PROJECT ACTIVITIES IN NICARAGUA. SHULTZ

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AID 1020-28 (7-71)
SUPPLEMENT 1

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

(INSTRUCTION: THIS IS AN OPTIONAL FORM WHICH CAN BE USED AS AN AID TO ORGANIZING DATA FOR THE PAR REPORT. IT NEED NOT BE RETAINED OR SUBMITTED.)

Life of Project:
From FY _____ to FY _____
Total U.S. Funding _____
Date Prepared: _____

Project Title & Number: Integrated Pest Management - 596-0110

PAGE 1

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Program or Sector Goal: The broader objective to which this project contributes:	Measures of Goal Achievement:		Assumptions for achieving goal targets:
To help increase agricultural productivity of CA/P region and enhance health and living standards or rural families in the region.	1. Sustained increase in farm production in CA/P. 2. Increased real farm income 3. Improved rural health and standard of living.	1. National and international census figures. 2. Data from appropriate national ministries	Political instability will not adversely affect agricultural production

AID 1020-28 (7-71)
SUPPLEMENT 1

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Life of Project:
From FY _____ to FY _____
Total U.S. Funding _____
Date Prepared: _____

Project Title & Number: _____

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Project Purpose:	Conditions that will indicate purpose has been achieved: End of project status.		Assumptions for achieving purpose:
To strengthen national and regional capabilities for development and implementation of effective IPM in CA/P	1. Permanent capacity at CATIE to provide appropriate and cost effective training and technical assistance in IPM.	1. Documents and records of CATIE, other international organizations, and national institutions.	1. Appropriate public and private institutions cooperate with and support the project.
	2. National institutions and appropriate private sector groups in CA/P sensitized to the merits of IPM.	2. Workshop attendance, national institutional linkages with farmers. Private sector participation.	
	3. Improved technician capability for implementation of IPM in CA/P.	3. 19 students achieving diplomas in IPM study.	
	4. Better crop protection information made available to farmers in CA/P, including quarterly newsletter.	4. CATIE published reports, newsletters, etc.	

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AID 1020-28 (7-71)
SUPPLEMENT 1

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Life of Project:
From FY _____ to FY _____
Total U.S. Funding _____
Date Prepared: _____

Project Title & Number: _____

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Outputs:	**Magnitude of Outputs:**		**Assumptions for achieving outputs:**
A. Research			
1. Biological and economic assessment of crop losses to pests.	1.a. Organized research effort to assess biological and economic losses caused by pests and to design, test, and validate IPM technology. b. Computerized list of major pests of small farm crops. c. 1 Regional Workshop.	1. Project records, publications, and educational materials.	1. Appropriate professional personnel are available to participate in the project.
	2. Data base describing crop losses caused by pests and the influence of improved IPM technology of these losses, including 10 pest loss assessments and 100 economic threshholds established on major pests of small farm crops.		2. Logistical support will be provided.
	3.a. Information and educational materials developed leading to the extension of improved IPM technology. b. 100 Field tests on small farms and 140 IPM validated evaluations. 4. Economic benefits based on 120 evaluations published and distributed.		3. Appropriate public and private institutions cooperate with and support the project.

AID 1020-28 (7-71)
SUPPLEMENT I

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Life of Project:
From FY _____ to FY _____
Total U.S. Funding _____
Date Prepared: _____

Project Title & Number: _____

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Outputs:	**Magnitude of Outputs:**		**Assumptions for achieving outputs:**
B. Training			
1. Speciality training for project personnel	1.a. 1 workshop for 9 project personnel b. In-service Study tours	1. Project reports, publications and evaluations.	1. Appropriate professional personnel are available to participate in the project.
2. Public awareness and technical training of individuals impacting agricultural policies and practices in the region, such as: - administrators - teachers - extension personnel - agribusiness personnel - public health personnel - Peace Corps Volunteers	2.a. 13 seminars with 140 total participants b. 29 workshops with 750 total participants c. 5 final conferences with 1,000 total participants	2. National records	2. Logistical support will be provided.
3. Academic and in-service training	3.a. 4 PH.D. candidates trained in the U.S. b. 15 M.S. candidates trained at CATIE c. 15 participants in post graduate, non-degree courses		3. Appropriate public and private institutions cooperate with and supprt the project.
4. Training Materials	4.a. 25 training modules on IPM practices made available to national institutions. b. Courses and curricula developed for high schools and post-high school non-degree institutions in the region.		

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AID 1020-28 (7-71)
SUPPLEMENT I

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Life of Project:
From FY _____ to FY _____
Total U.S. Funding _____
Date Prepared: _____

Project Title & Number: _____

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Outputs:	**Magnitude of Outputs:**		**Assumptions for achieving outputs:**
C. Technical Cooperation			
1. Regional and national pest diagnostic services	1. Comprehensive, region-wide pest specimen collection assembled at CATIE and pest identification and diagnostic services made available to target audience.	1. Regional diagnostic center records	1. Appropriate professional personnel are available to participate in the project.
2. Regional IPM information management and dissemination	2.a. Comprehensive IPM information base developed at CATIE and made available to all interested groups. b. Photocopy services and library loans/referral services made available by CATIE to all interested groups. c. Newsletter published on quarterly basis.	2. IPM Newsletter	2. Logistical support will be provided.
3. Technical assistance in IPM training, research and implementation	3.a. 25 short-term consultancies provided by specialized consultants b. Regular assistance provided by project staff to national public and private sector institutions and individuals.	3. An evaluation to determine if regional agricultural technicians have increased capability to recognize and solve pest problems using IPM methodologies. 4. Evolution of self sustaining systems for information management and pest diagnosis, by end of project 5. Project and national records and reports.	3. Appropriate public and private institutions cooperate with and support the project.

AID 1020-28 (7-71)
SUPPLEMENT 1

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Life of Project:
From FY _____ to FY _____
Total U.S. Funding _____
Date Prepared: _____

Project Title & Number: _____

NARRATIVE SUMMARY		OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Inputs: ($000)		Implementation Target (Type and Quantity)		Assumptions for providing inputs:
1. AID				
- Personnel	2,741		ROCAP accounting records.	Inputs will be provided on a timely basis
- Equipment & Materials	441			
- Training	946			
- Construction	90			
- Travel & Per Diem	400			
- Evaluation	90			
- Printing & Publication	50			
- Inflation/Contingency	765			
- Overhead	1,227			
	6,750			
2. CATIE				
- Personnel	588		CATIE accounting records.	
- Equipment & Materials	87			
- Training	50			
- Printing & Publication	25			
	750			

ANNEX I.C

5C(2) PROJECT CHECKLIST

Listed below are statutory criteria applicable to projects. This section is divided into two parts. Part A. includes criteria applicable to all projects. Part B. applies to projects funded from specific sources only: B.1. applies to all projects funded with Development Assistance Funds, B.2. applies to projects funded with Development Assistance loans, and B.3. applies to projects funded from ESF.

CROSS REFERENCES: IS COUNTRY CHECKLIST UP TO DATE? HAS STANDARD ITEM CHECKLIST BEEN REVIEWED FOR THIS PROJECT?

A. GENERAL CRITERIA FOR PROJECT

1. FY 1982 Appropriation Act Sec. 523; FAA Sec. 634A; Sec. 653(b).

(a) Describe how authorizing and appropriations committees of Senate and House have been or will be notified concerning the project; (b) is assistance within (Operational Year Budget) country or international organization allocation reported to Congress (or not more than $1 million over that amount)?

a. Congressional Notification Process

b. The project is included in the FY 1984 Supplemental submitted to the Congress

2. FAA Sec. 611(a)(1). Prior to obligation in excess of $100,00, will there be

(a) engineering, financial or other plans necessary to carry out the assistance and (b) a reasonably firm estimate of the cost to the U.S. of the assistance?	a. Yes b. Yes
3. FAA Sec. 611(a)(2). If further legislative action is required within recipient country, what is basis for reasonable expectation that such action will be completed in time to permit orderly accomplishment of purpose of the assistance?	N.A.
4. FAA Sec. 611(b); FY 1982 Appropriation Act Sec. 501. If for water or water-related land resource construction, has project met the standards and criteria as set forth in the Principles and Standards for Planning Water and Related Land Resources, dated October 25, 1973? (See AID Handbook 3 for new guidelines.)	N.A.
5. FAA Sec. 611(e). If project is capital assistance (e.g., construction), and all U.S. assistance for it will exceed $1 million, has Mission Director certified and Regional Assistant Administrator taken into consideration the country's capability effectively to maintain and utilize the project?	N.A.

6.	FAA Sec. 209. Is project susceptible to execution as part of regional or multilateral project? If so, why is project not so executed? Information and conclusion whether assistance will encourage regional development programs.	Project is a regional effort
7.	FAA Sec. 601(a). Information and conclusions whether project will encourage efforts of the country to: (a) increase the flow of international trade; (b) foster private initiative and competition; and (c) encourage development and use of cooperatives, and credit unions, and savings and loan associations; (d) discourage monopolistic practices; (e) improve technical efficiency of industry, agriculture and commerce; and (f) strengthen free labor unions.	a) No direct impact b) No direct impact c) No direct impact d) No direct impact e) No direct impact f) No direct impact
8.	FAA Sec. 601(b). Information and conclusions on how project will encourage U.S. private trade and investment abroad and encourage private U.S. participation in foreign assistance programs (including use of private trade channels and the services of U.S. private enterprise).	U.S. technical assistance will be utilized and U.S. commodities will be purchased from U.S. private enterprise.

9.	FAA Sec. 612(b), 636(h); FY 1982 Appropriation Act Sec. 507. Describe steps taken to assure that, to the maximum extent possible, the country is contributing local currencies to meet the cost of contractual and other services, and foreign currencies owned by the U.S. are utilized in lieu of dollars.	The regional institution will contribute 10% to project costs.
10.	FAA Sec. 612(d). Does the U.S. own excess foreign currency of the country and, if so, what arrangements have been made for its release?	No
11.	FAA Sec. 601(e). Will the project utilize competitive selection procedures for the awarding of contracts, except where applicable procurement rules allow otherwise?	Yes
12.	FY 1982 Appropriation Act Sec. 521. If assistance is for the production of any commodity for export, is the commodity likely to be in surplus on world markets at the time the resulting productive capacity becomes operative, and is such assistance likely to cause substantial injury to U.S. producers of the same, similar or competing commodity?	N.A.
13.	FAA 118(c) and (d). Does the project comply with the environmental procedures set forth in AID Regulation 16? Does	Yes

the project or program take into consideration the problem of the destruction of tropical forests?	N.A.
14. FAA 121(d). If a Sahel project, has a determination been made that the host government has an adequate system for accounting for and controlling receipt and expenditure of project funds (dollars or local currency generated therefrom)?	N.A.

B. FUNDING CRITERIA FOR PROJECT

1. Development Assistance Project Criteria

a. FAA Sec. 102(b), 111, 113, 281(a). Extent to which activity will (a) effectively involve the poor in development, by extending access to economy at local level, increasing labor-intensive production and the use of appropriate technology, spreading investment out from cities to small towns and rural areas, and insuring wide participation of the poor in the benefits of development on a sustained basis, using the appropriate U.S. institutions; (b) help develop cooperatives, especially by technical assistance, to assist rural and urban poor to help themselves toward better life, and	a) IPM is a means of increasing productivity through the use of appropriate crop protection technologies. b) Existing farmer cooperatives can be expected to participate in project activities and, ultimately, receive training from national extension services. c) The project will strengthen regional and national capacities to deliver IPM technologies d) Long-term health benefits from improved use of pesticides will accrue to women throughout rural Central America. e) The project will be implemented by a regional institution in close collaboration with participating countries.

otherwise encourage democratic private and local governmental institutions; (c) support the self-help efforts of developing countries; (d) promote the participation of women in the national economies of developing countries and the improvement of women's status; and (e) utilize and encourage regional cooperation by developing countries?	
b. FAA Sec. 103, 103A, 104, 105, 106. Does the project fit the criteria for the type of funds (functional account) being used?	Yes
c. FAA Sec. 107. Is emphasis on use of appropriate technology (relatively smaller, cost-saving, labor-using technologies that are generally most appropriate for the small farms, small businesses, and small incomes of the poor)?	Project will focus on appropriate low-cost technologies.
d. FAA Sec. 110(a). Will the recipient country provide at least 25% of the costs of the program, project, or activitiy with respect to which the assistance is to be furnished (or is the latter cost-sharing requirement being waived for a "relatively least developed" country)?	N.A. Assistance is to regional organization; however, substantial resources will be committed by each participating country to support in-country activities.

e. FAA Sec. 110(b). Will grant capital assistance be disbursed for project over more than 3 years? If so, has justification satisfactory to Congress been made, and efforts for other financing, or is the recipient country "relatively least developed"? (M.O. 1232.1 defined a capital project as "the construction, expansion, equipping or alteration of a physical facility or facilities financed by AID dollar assistance of not less than $100,000, including related advisory, managerial and training services, and not undertaken as part of a project of a predominantly technical assistance character."	N.A.
f. FAA Sec. 122(b). Does the activity give reasonable promise of contributing to the development of economic resources, or to the increase of productive capacities and self-sustaining economic growth?	Yes
g. FAA Sec. 281(b). Describe extent to which program recognizes the particular needs, desires, and capacities of the people of the country; utilizes the country's intellectual resources to encourage	Regional program involves cooperating national technical institutions. Training of national technicians in IPM and technical assistance needs were based on consultants' reports and interviews with technicians from public and private sector institutions in the region.

institutional development; and supports civil education and training in skills required for effective participation in governmental processes esential to self-government.

2. Development Assistance Project Criteria (Loans Only)

a. FAA Sec. 122(b). Information and conclusion on capacity of the country to repay the loan, at a reasonable rate of interest. N/A

b. FAA Sec. 620(d). If assistance is for any productive enterprise which will compete with U.S. enterprises, is there an agreement by the recipient country to prevent export to the U.S. of more than 20% of the enterprise's annual production during the life of the loan? N/A

c. ISDCA of 1981, Sec. 724 (c) and (d). If for Nicaragua, does the loan agreement require that the funds be used to the maximum extent possible for the private sector? Does the project provide for monitoring under FAA Sec. 624(g)? N/A

3. Economic Support Fund Project Criteria

a. FAA Sec. 531(a). Will this assistance promote economic or political N/A

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	stability? To the extent possible, does it reflect the policy directions of FAA Section 102?	
b.	FAA Sec. 531(c). Will assistance under this chapter be used for military, or paramilitary activities?	N/A
c.	FAA Sec. 534. Will ESF funds be used to finance the construction of the operation or maintenance of, or the supplying of fuel for, a nuclear facility? If so, has the President certified that such use of funds is indispensable to nonproliferation objectives?	N/A
d.	FAA Sec. 609. If commodities are to be granted so that sale proceeds will accrue to the recipient country, have Special Account (counterpart) arrangements been made?	N/A

5C(3) - STANDARD ITEM CHECKLIST

Listed below are the statutory items which normally will be covered routinely in those provisions of an assistance agreement dealing with its implementation, or covered in the agreement by imposing limits on certain uses of funds.

These items are arranged under the general headings of (A) Procurement, (B) Construction, and (C) Other Restrictions.

A. Procurement

1.	FAA Sec. 602. Are there arrangements to permit U.S. small business to participate equitably in the furnishing of commodities and services financed?	Yes
2.	FAA Sec. 604(a). Will all procurement be from the U.S. except as otherwise determined by the President or under delegation from him?	Yes
3.	FAA Sec. 604(d). If the cooperating country discriminates against marine insurance companies authorized to do business in the U.S., will commodities be insured in the United States against marine risk with such a company?	Yes
4.	FAA Sec. 604(e); ISDCA of 1980 Sec. 705(a). If offshore procurement of agricultural commodity or product is to be	N/A

	financed, is there provision against such procurement when the domestic price of such commodity is less than parity? (Exception where commodity financed could not reasonably be procured in U.S.)	
5.	FAA Sec. 604(g). Will construction or engineering services be procured from firms of countries otherwise eligible under Code 941, but which have attained a competitive capability in international markets in one or these areas?	Yes
6.	FAA Sec. 603. Is the shipping excluded from compliance with requirement in section 901(b) of the Merchant Marine Act of 1936, as amended, that at least 50 per centum of the gross tonnage of commodities (computed separately for dry bulk carriers, dry cargo liners, and tankers) financed shall be transported on privately owned U.S. flag commercial vessels to the extent that such vessels are available at fair and reasonable rates?	Project will comply with Section 901 (b) requirements.
7.	FAA Sec. 621. If technical assistance is financed, will such assistance be furnished by private enterprise on a contract basis to the fullest extent practicable? If the facilities of other	Yes.

Federal agencies will be utilized, are they particularly suitable, not competitive with private enterprise, and made available without undue interference with domestic programs?	Yes
8. International Air Transport. Fair Competitive Practices Act, 1974. If air transportation of persons or property is financed on grant basis, will U.S. carriers be used to the extent such service is available?	Yes
9. FY 1982 Appropriation Act Sec. 504. If the U.S. Government is a party to a contract for procurement, does the contract contain a provision authorizing termination of such contract for the convenience of the United States?	Yes

B. Construction

1. FAA Sec. 601(d). If capital (e.g., construction) project, will U.S. engineering and professional services to be used?	N/A
2. FAA Sec. 611(c). If contracts for construction are to be financed, will they be let on a competitive basis to maximum extent practicable?	N/A

3. FAA Sec. 620(k). If for construction of productive enterprise, will agggregate value of assistance to be furnished by the U.S. not exceed $100 million (except for productive enterprises in Egypt that were described in the CP)?	N/A
C. Other Restrictions	
1. FAA Sec. 122(b). If development loan, is interest rate at least 2% per annum during grace period and at least 3% per annum thereafter?	N/A
2. FAA SEc. 301(d). If fund is established solely by U.S. contributions and administed by an internatioal organization, does Comptroller General have audit rights?	N/A
3. FAA Sec. 620(h). Do arrangements exist to insure that United States foreign aid is not used in a manner which, contrary to the best interests of the United States, promotes or assists the foreign aid projects or activities of the Communist-bloc countries?	Yes
4. Will arrangements preclude use of financing:	
a. FAA Sec. 104(f); FY 1982 Appropriation Act Sec. 525: (1) To pay for performance of abortions as a method of family	Yes

planning or to motivate or coerce persons to practice abortions; (2) to pay for performance of involuntary sterilization as method of family planning, or to coerce or provide financial incentive to any person to undergo sterilization; (3) to pay for any biomedical research which relates, in whole or part, to methods or the performance of abortions or involuntary sterilizations as a means of family planning; (4) to lobby for abortion?	
b. FAA Sec. 620(g). To compensate owners for expropriated nationalized property?	Yes
c. FAA Sec. 660. To provide training or advice or provide any financial support for police, prisons, or other law enforcement forces, except for narcotics programs?	Yes
d. FAA Sec. 662. For CIA activities?	Yes
e. FAA Sec. 636(i). For purchase, sale, long-term lease, exchange or guaranty of the sale of motor vehicles manufactured outside U.S., unless a waiver is obtained?	Yes
f. FY 1982 Appropriation Act, Sec. 503. To pay pensions, annuities, retirement pay, or	Yes

adjusted service compensation for military personnel?	
g. FY 1982 Appropriation Act, Sec. 505. To pay U.N. assessments, arrearages or dues?	Yes
h. FY 1982 Appropriation Act, Sec. 506. To carry out provisions of FAA section 209(d) (Transfer of FAA funds to multilateral organizations for lending)?	Yes
i. FY 1982 Appropriation Act, Sec. 510. To finance the export of nuclear equipment, fuel, or technology or to train foreign nationals in nuclear fields?	Yes
j. FY 1982 Appropriation Act, Sec. 511. Will assistance be provided for the purpose of aiding the efforts of the government of such country to repress the legitimate rights of the population of such country contrary to the Universal Declaration of Human Rights?	Such assistance will not be provided
k. FY 1982 Appropriation Act, Sec. 515. To be used for publicity or propaganda purposes within U.S. not authorized by Congress?	Yes

ANNEX I-D

CENTRO AGRONOMICO TROPICAL
DE INVESTIGACION Y ENSEÑANZA

Turrialba - Costa Rica - Teléfonos: 56-64-31 - 56-01-69 - Telex: 8005 CATIE C. R. - Cable: CATIE Turrialba

D-778
March 9, 1984

Mr. John Eyre
Acting Director
ROCAP-Guatemala
C/O American Embassy
Guatemala, GUATEMALA

Dear Mr. Eyre:

As I assume my new duties as Director of CATIE, I would like to express my gratitude for the excellent support that this Center has received from AID through ROCAP during the last few years, and at the same time inform you that I look forward to continuing this close working relationship between our two Institutions as we progress with ongoing projects and develop new ones of vital interest to this area.

Personnel of CATIE's Department of Crop Production have talked on an informal basis with personnel of national institutions in charge of agricultural development in the Central American Isthmus about the pest problem and the irrational use of pesticides, and the need for doing studies on improved methods of combating these pests and the rational use of such pesticides. All of the persons consulted are in complete agreement with the need for a regional project to find solutions to these problems.

During the month of February, I understand that a Technical Design Team, contracted through CICP to assist ROCAP with the Project Paper design for the Integrated Pest Management Project, visited this Center to prepare the necessary required documentation to be submitted to AID for its approval of reference IPM Project.

We believe this Project will have a great impact on increasing the net income of farmers, especially small-scale producers, thereby making it possible for them to enjoy a better way of life.

..../

I wish to inform you that I give my full support to the Project on Integrated Pest Management as being developed. Due to the importance of the Project, I request most respectfully that funds be approved by AID for this Project.

I look forward to a favorable response on the part of AID through ROCAP to the Project Proposal, which will provide still another opportunity for a collaborative effort in a very important aspect of rural development in the Central American Isthmus.

With my very best wishes, I remain

Sincerely yours,

Rodrigo Tarté
Director

c.c.: CBurgos
AGutiérrez
DJoslyn
JSaunders

RT/ALE/fsp

ANNEX E

Draft Project Authorization

Name of Entity : Tropical Center for Agricultural Research and Training (CATIE)

Name of Project : Integrated Pest Management

Number of Project: 596-0110

1. Pursuant to Section 103 of the Foreign Assistance Act of 1961, as amended, I hereby authorize the Integrated Pest Management Project with the Tropical Center for Agricultural Research and Training ("CATIE"), involving planned obligations of not to exceed Six Million Seven Hundred Fifty Thousand United States Dollars ($6,750,000) in grant funds ("Grant") over a five-year period from the date of authorization, subject to the availability of funds in accordance with the A.I.D. OYB/allotment process, to help in financing foreign exchange and local currency costs for the Project.

2. The project ("Project") consists of assistance to CATIE to strengthen the capacities of national and regional organizations in Central America and Panama to develop and implement effective integrated pest management practices through a) research, b) training, and c) advisory services.

3. The Project Agreement, which may be negotiated and executed by the officer to whom such authority is delegated in accordance with A.I.D. regulations and Delegations of Authority, shall be subject to the following essential terms and covenants and major conditions, together with such other terms and conditions as A.I.D. may deem appropriate.

a. Source and Origin of Commodities, Nationality of Services

Commodities financed by A.I.D. under the Grant shall have their source and origin in countries which are members of the Central American Common Market ("CACM"), Panama, or the United States, except as A.I.D. may otherwise agree in writing. Except for ocean shipping, the suppliers of commodities or services shall have countries which are members of CACM, Panama or the United States as their place of nationality, except as A.I.D. may otherwise agree in writing. Ocean shipping financed by A.I.D. under the Grant shall be financed only on flag vessels of the United States, except as A.I.D. may otherwise agree in writing.

b. Conditions Precedent to Disbursement

(1) Prior to the disbursement, or the issuance of any commitment documents under the Project Agreement to finance activities other than for hiring long-term personnel, CATIE shall, except as A.I.D. may otherwise agree in writing, furnish, in form and substance satisfactory to A.I.D., a detailed time-phased plan setting forth all activities to be completed during the first year of the project.

(2) Prior to the disbursement, or the issuance of any commitment documents under the Project Agreement to finance activities in any one of the participating countries, CATIE shall, except as A.I.D. may otherwise agree in writing, furnish, in form and substance satisfactory to A.I.D., an executed letter of agreement with the primary agriculture institution of that particular eligible participating country. The letters of agreement shall, inter alia, contain provisions which outline the roles of CATIE and the national institution; establish working relationships between CATIE, country coordinators and national institutions; and identify national inputs to the project.

c. Covenants

CATIE shall covenant that, except as A.I.D. May otherwise agree in writing:

(1) All fees and services provided under the Project shall be used to finance costs related to the Project;

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(2) CATIE shall provide appropriate housing for the long-term advisors at CATIE funded under the Project Agreement;

(3) CATIE will coordinate project activities with USAID missions in each country which participates in this project;

(4) Prior to undertaking project activities for each year after the first year of the Project, CATIE will furnish, in form and substance satisfactory to A.I.D., a consolidated workplan and budget for activities for that year.

_____
Marshall D. Brown
Acting Assistant Administrator
Burea for Latin America and
the Caribbean

Date_____

ANNEX I-F

TECHNICAL ANALYSIS

A. Introduction

The regional IPM project is intended to promote an improved state of understanding of the concepts and application of integrated pest management in CA/P, especially as related to small-scale producers of food and cash crops. The approach to this broad objective is focused on three components: research, training, and technical cooperation. The following discussions are intended to provide a general perspective of these components, and to indicate certain constraints and considerations that should be recognized.

B. Research

1. Crop Loss Assessment

A rational consideration of the need to implement a program to control any crop pest requires a knowledge of the relative importance of the damage that the pest inflicts. Damage, or crop loss, generally is expressed in either of two ways, i.e., physical or economic loss.

Physical loss, be it qualitatively or quantitatively estimated, indicates the amount of damage to crop plants or crop products, e.g., percent leaf loss, percent yield loss, reduction in grade, etc. Physical losses, however, may not directly reflect economic losses, as would be the case where partial loss of leaf area to a leaf-feeding insect in a bean crop might not adversely affect yield. On the other hand, economic loss is a more meaningful criterion, as it translates physical losses into an expression of economic value which provides a better basis for assessing the need for pest control. The concept of economic loss can be extended, although less tangibly, to situations in which the absolute quantity of crop loss to pests may not be as important as the effects of this loss on nutrition levels, human productivity, and longevity.

The absolute impact or status of a pest is a function of at least six factors, including the following:

- The area of susceptible crop where conditions are favorable for pest attack.

- The distribution over that area of the probability that localities within the area will experience pest attack.

- Average level of attack, when attack does occur.

- The physical crop loss per unit area that occurs under the average level of attack when traditional control actions are undertaken.

- The true value of physical losses.

- Current availability and cost of control, including the possible cost in farmer decisions not to plant a given crop because of its vulnerability to pests.

Obviously, the data criteria to be satisfied for rigorous crop loss assessment are complex; they rarely can be satisfied under ideal conditions, and are prohibitively expensive for consideration in the IPM project. Since data for thorough loss assessments cannot feasibly be collected, it is necessary to consider turning to experienced regional crop protection specialists for their collective opinions on relative importance of pests in the region. At the same time, crop loss assessments, whether obtained objectively from analysis of regional data or qualitatively from experts' opinions, may not reflect the relative severity of pest problems as perceived by producers.

The foregoing discussion adequately points up a primary need in the IPM project to identify major pest problems of the principal small-farm crops in CA/P, to estimate the relative economic impact of major pests in target farming systems and to determine how farmers' perceptions of major pest problems correlate with assessments developed by crop protection specialists. Satisfactory answers to these questions are apparent pre-requisites to the planning and implementatijon of IPM research and to the allocation of research resources in the program.

The problem of crop loss assessment involves, first of all, an inventory of pests and pest complexes that cause damage to the project-targeted food and cash crops that may be part of small farmer operations in CA/P. This pest inventory activity, and the succeeding crop loss assessments, should be developed in a regional context; since pest problems are likely to be common among countries and significant economies of scale can be achieved by organizing the efforts at a regional level, rather than performing separate country-specific efforts.

Identification of regional crop pest problems can be effectively accomplished with workshops attended by crop protection specialists familiar with Central America agriculture. Participants in these workshops should be drawn from various relevant disciplines to encourage a comprehensive evaluation of relevant crop and pest variables. Involvement of pesticide specialists and agricultural consultants from the private sector should be encouraged. Workshop groups will develop an inventory list of known insect, weed, pathogen, nematode, and other pest problems in targeted cropping systems in the CA/P region, and then evaluate the pests or pest complexes for relative importance.

The workshop activities would be supplemented by a thorough literature search for information on crop loss assessments for the cataloged pests. Data and information from the two sources then can be utilized to develop an index of expected physical losses which can be translated into a preliminary set of economic loss indexes. At this point, it would be advisable to survey target farmers to determine their perception of pest problems. The survey information then can be integrated with the specialists' loss data to finalize crop loss assessment guidelines applicable to crops in the region.

The research on crop loss assessment should generate two important publications: 1) a catalog of major pests of food crops in Central America and 2) a crop loss assessment handbook. These would be widely distributed to crop protection specialists, research administrators, extension personnel, and other agricultural workers interested in IPM.

2. Approaches and methods in IPM

In most cropping systems in which IPM is practiced, different approaches are used for pest management. These may take the form of multiple approaches for management of a single pest, or a sequence of approaches for management of a pest complex. Generally, and pragmatically, IPM approaches in agriculture can be designated as cultural, biological, chemical or pesticidal, and mechanicalphysical. Within each of these approaches, various methods are employed for pest control. When a pest problem has been identified and judged to be economically significant, a producer must make a decision of what general approaches and methods will be most appropriate and feasible. This choice should be based on such considerations as characteristics of the pest or pest complex, biology and value of the crop, financial constraints, cost of control, technical capabilities, health and environmental concerns, etc. Obviously, this decision-making process is a complex one, and presumes the availability of technical information relevant to the problem at hand.

In CA/P this condition is not well satisfied, especially for the complex of small-farm cropping systems that produce the bulk of the major food crops in the region.

Development and evaluation of pest management methods for CA/P is an important research component of the IPM project. This effort will be implemented at two levels: (1) a level of relatively basic or developmental research and (2) on-farm applied research. The major portion of the research effort will be directed to applied work, either in small-scale farm plots or in more extensive on-farm validation tests, in much the same way that the CATIE Small Farm Production Systems project is structured. Developmental research will not be ignored, even though a lesser portion of the total research resources will be assigned to it. The developmental effort will be aimed at problem-solving, that is, to resolution of technical problems that best can be addressed in formalized experiments in which test variables can be adequately controlled. This level of research will serve to define and evaluate principles, methods, and techniques for pest control, which then can be extended for on-farm evaluation.

The IPM research component on pest management practices will focus on pest problems that mainly are of regional importance in food and cash crops produced on small farms. A priority effort will be aimed at on-farm activities in which pest control methods can be applied and evaluated in an overall "real" production context. This approach will facilitate an examination of the biological, environmental, economic, and sociological variables associated with integrated pest management, and provide a sound basis for regional extension of research findings.

A variety of control alternatives can be applied in prescribing an integrated pest management program for a particular crop-pest situation. All will be considered in designing the IPM pest control research effort.

a. Cultural control. The cultural approach to pest control involves manipulation of the crop and its immediate environment to make the crop less favorable for pest organisms. A few examples illustrate the diversity of altenative methods that are applicable to a cultural control approach:

- Alteration of planting date to avoid vulnerability to pest attacks during certain stages of crop development.

- Rotation of crop to reduce buildup and damage potential of target pests.

- Destruction of crop residues to limit carryover of pests.

- Reduced tillage to decrease nematode populations and minimize resurgence of weed species.

- Modification of planting patterns to enhance crop competitivness with weeds.

b. Biological control. This approach to pest management utilizes endemic or introduced natural enemies (predators, pathogens, parasites) to keep target pest populations below economically damaging levels. Examples of the biological approach include the use of Bacillus thuringiensis, a bacterium, to control larvae of certain lepidopterous pests of vegetable crops and the release of the Trichogramma wasp for control of Heliothis spp. in cotton.

c. Mechanical-physical control. For certain types of pests, various mechanical or physical methods afford adequate levels of pest control by restricting their entry, survival, or access to crop plants or crop products. Typical mechanical-physical methods include use of traps for rodents and birds, metal rat barriers on coconut trees, rodent and bird-proof containers for stored grains, hand removal of pests, etc.

d. Pesticidal control. Several types of chemical compounds are used for controlling pests, including insecticides, fungicides, acaricides, rodenticides, herbicides, and nematicides. These may be utilized for either preventive or remedial treatment. Preventive use of chemical pesticides prevents the development of a pest population or protects a crop from attack by an existing pest population. Remedial treatments are used to control a pest population after it has developed or has already attacked a crop, but not before economic damage has occurred. In IPM, remedial control usually is a more acceptable practice than is preventive treatment.

e. Host plant resistance. Pest-resistant crop cultivars offer unique advantages in pest management. Their use produces the need for pesticides and generally does not inolve any additional cost for seed. Host plant resistance is relatively permanent, in most cases, and eliminates the need for repetitive actions to control pests.

All of the pest control approaches and methods described offer viable alternatives for management of pests in the regional IPM program. Obviously, selection of an appropriate procedure will depend on many factors, as noted previously. The crop loss assess-

ment guidelines to be developed in early stages of the project will provide useful indices for assessing the need for control.

To the maximum practicable extent, the IPM research effort will focus on combinations of pest control methods and attempt to identify systems of pest management that are both effective and compatible with the financial, technical, and sociological constraints that influence small farmers' action alternatives.

Following are two case studies that demonstrate how IPM practices could be used effectively in management of pests CA/P.

a. Black Sigatoka. This disease occurs worldwide in hot humid lowland tropics, and probably is the most serious disease of the banana and plantain. It is especially significant in the Central American lowlands where plantain is a major food source for low income families. The disease is controllable with fungicides, but most small farmers cannot afford the materials or equipment required for effective fungicidal treatment. A number of practices, applied singly or in concert, are known to reduce the severity of Black Sigatoka, including the following:

- wider inter-plant spacing to improve air circulation.
- better surface drainage to lower humidity.
- cleaner cultivation to reduce weed growth and reduce humidity and enhance air circulation.
- improved sanitation, especially removal and destruction of infested or dead leaves that serve as a source of inoculum.
- interplanting plantain with shade trees to reduce disease severity.
- use of Sigatoka-resistant cultivars Pelipita and Saba.

Effectiveness of these practices has been demonstrated in the lowland areas where banana and plantain are extensively grown but little information is available on the efficiency of these practices under small farm culture. The disease offers a fertile opportunity for fundamental and applied research within the IPM project.

b. "Tapado" culture of beans. Dry beans are important in human nutrition in Latin America where middleand low-income families are unable to produce or purchase sufficient animal protein. Traditionally, beans have constituted as much as ten percent of diets in the region, but per capita consumption is falling as production increases fall behind population increases. A significant factor limiting production increase is bean diseases, including web blight, which is a major bean disease during the rainy season and under conditions of high temperature and humidity .

In the Central American region, many small farmers use a system of bean production called "frijol tapado," which means "covered beans." This practice involves broadcasting bean seeds in selected patches of broadleaf weeds, then cutting the weeds with machete, leaving a weed mulch on the area. The bean seeds germinate under the mulch, and bean plants grow through the mulch and eventually cover it. The combination of mulch and bean plants effectively prevents weed growth, conserves soil moisture, and reduces soil erosion. In addition, the mulch prevents splashing onto bean leaves of soil, which is the major source of inoculum for the web blight disease. Data from research studies show that the tapado system gives better control of web blight than does treatment with the fungicide PCNB.

Both of the IPM systems provide excellent illustration of how relatively uncomplicated practices can provide effective levels of pest management in the CA/P region.

3. Pesticide Management Research

Chemical pesticides are employed in integrated pest management as a tactic for control of pest populations. Although use of pesticides is a valuable control tactic, certain problems arise from misuse of these chemical agents. These include (1) development of genetic resistance, in both target and non-target organisms, to chemical pesticides; (2) toxicity to humans, domestic animals, wildlife, and other non-target species; (3) unacceptable levels of pesticide residues in food and feed products; (4) contamintion of soil, ground water, and the general environment; and (5) disposal of unused chemicals and containers.

The problems just noted emphasize the obvious need to consider safety priorities in designing and implementing pesticide management. To a considerable degree, proper pesticide use is a matter of common sense and the exercise of thoughtful judgement about the purpose and manner with which chemical pesticides are used. Planners and applicators, be they professionals or farmers, should

be cognizant of use restrictions and hazards in pesticide use. Pesticide selection, dosages, and application methods must be carefully considered to assure acceptable levels of safety, while also providing the required level of pest control. Due regard should be given to application equipment in respect to utility, safety, cost, and maintenance. Personal safety can be enhanced by use of protective apparel and prudence in handling, storage, mixing, and application of pesticides.

While safety considerations are relatively easy to perceive and implement, other hazards associated with pesticide use are more subtle and less likely to be appreciated. Development of genetic resistance to chemical pesticides by a pest organism has been demonstrated in numerous species. Excellent examples are provided by the development of resistance in Heliothis spp. to the chlorinated hydrocarbon insecticides, and by the progessive development in certain spider mites of resistance to traditional insecticides.

The phenomenon of resistance is a logical consequence of natural selection in pest populations that are exposed to pressures imosed by continual exposure to chemical pesticides, i.e., "survival of the fittest." This process occurs both in pest species that are the prime target of pesticide treatment and in non-target species within the same general confines as the target pest. This type of non-target response has been observed in Guatemala where mosquito popuations in cotton-growing areas have developed high levels of genetic resistance to chemical compounds used for control of pests in cotton. Again, careful judgement in pesticide selection and use, in conjunction with collaboration of public heath officials, will minimize this hazard.

More insidious is the process by which toxic constituents can be introduced into the food chain of humans, domestic animals, wildlife, aquatic species, birds, etc. Even with proper application, a certain amount of an insecticide is released into the environment of target crops. With misuse or overuse, the amounts become excessive, resulting in buildup of toxicants in soil, ground water, and non-target plant and animal species. Transfer of persistent toxic compounds from one element to another in the food chain sequence may culminate in excessive levels of harmful chemicals in plant and animal products used for human food. This phenomenon ma be especially hazardous in the case of pesticide compounds that not easily metabolized by either biological systems or environmental factors.

Direct contamination of food products is an obvious hazard in crop production systems, especially with chemical pesticides that

are not readily degraded by sunlight, temperature, or other environmental factors. When this type of product contamination is poorly controlled and inadequately monitored, the economic, as well as health, consequences may become very significant. For example, imports of agricultural products from certain Central American countries have been restricted by the U.S. because of pesticide residues that exceed established tolerance limits.

Undoubtedly, chemicl controls will remain a major tactic for control of crop species in CA/P, and it will receive corresponding attention in the regional IPM project. The research proposed in pesticide management largely will be an intrinsic consideration in the research on IPM strategies and tactics, and not discretely separate from it. Opportunities exist for pesticide management research in the IPM project. Following are two areas of research to be developed in the IPM project.

a. Selection of alternative pesticides that are more compatible with IPM principles and less hazardous than conventionally used materials. The use of the herbicide paraquat is a case in point. This pesticide is commonly used several times a year to control weed pests in crops. The feasibility of replacing paraquat with such herbicides as glyphosate, sethoxydin, or fluazifop-butyl will be investigated. These three alternatives would provide equal or better weed control with greater applicator safety, and fit well into most cropping systems in CA/P.

b. Evaluation of pesticide application equipment should be initiated to identify types that provide improved operator safety, are less costly to purchase and maintain, are effective, and which decrease non-target deposition of pesticides. Sponge or rope applicators, electrostatic sprayers, and shielded sprayers offer considerable potential for effective use in IPM programs.

4. Socioeconomic Research

Social scientific input is required to support and aid in evaluation of pest management research. The interaction of research planners and managers with trained social scientists can be valuable in directing research to plant protection approaches most likely to achieve social, economic, and technical success. No systematic documentation of the social, economic, institutional, and other factors influencing IPM success in Central America is currently available to assure that new approaches have increased probability of success in improving farmers' situations.

Economists and/or other social scientists need to collaborate with crop protection specialists in order to attach appropriate socioeconomic measures to the outcomes of the pest management techniques developed and tested under this project. Past experience with other interdisciplinary projects demonstrates that social scientific input is most productive when it is available throughout all phases of research planning, development, implementation, and evaluation. If social scientific input is not obtained prior to evaluation stages, it is possible that experimental design and data collection will not yield the variables required for social and economic analysis.

Social scientists should provide a continuing input into the CA/P pest management project, primarily as collaborative support for the general research activities. They would function with other members of teams involved in planning, prosecution, and evaluation of research efforts.

An economist's input is requisite to the development of sound economic parameters in crop loss assessment, and input of sociologists, anthropologists, or other social scientists will be needed to coordinate a survey and assessment of how farmers perceive pest problems in their individual crop production schemes. Social scientists would have a special responsibility for developing the economic and social criteria for assessing expected research successes and for providing the socioeconomic interpretations needed for evaluating the impact and relevance of research results in the IPM project.

Following are examples of IPM-related situations in which socioeconomic analysis could be applied to IPM research activities.

a. If a new crop cultivar is developed or introduced as a means of reducing pest losses, a test of consumer produce preference may be needed to assess its social acceptability.

b. If a proposed new IPM approach requires that target producers utilize a different than usual mix of labor, capital, and managerial inputs to production, the feasibility of and expected net returns from the new practiuce need to be estimated using budget analysis, breakeven analysis, cost effectiveness, or other appropriate analytical techniques.

c. If improved pesticide management is expected to increase agricultural export opportunities, it is useful to place a value on the increased imports, for comparison with the cost of achieving them over the long run.

d. Similarly, if pest management approaches developed through the project affect the mix of pesticide materials used in CA/P, it would be particularly useful to assess the flow of pesticides and residues into and out of the region and evaluate changes in balance of payments and materials flow due to integrated pest management.

e. The ultimate success of the IPM project will have to be judged by how well it contributes to improved productivity and welfare of rural families in CA/P. This assessment certainly will hinge on the input of economists and sociologists as key personnel in such determinations.

5. Research Linkages

Optimum effectiveness of the IPM research project at CATIE will depend on development of active linkages with various other programs, institutions, and agencies. Foremost among them is the opportunity for a complementary interaction with the small farms production systems project at CATIE, and with other on-going research activities of the Center that are related to crop production and protection. Proximity to the University of Costa Rica in San Jose enhances opportunities for developing IPM-related research projects and training of graduate students in the IPM disciplines. The Costa Rican Ministry of Agriculture and Animal Husbandry (MAG) supports very limited IPM activity, but closer research linkages between MAG and CATIE will facilitate the development of improved pest management systems of national and regional importance. In a similar manner, several regional institutions provide opportunities for interaction by CATIE on matters related to pest management. These include the National School of Agriculture and the Panamerican School of Agriculture in Honduras, the University of San Carlos Faculty of Agriculture and the Del Valle University in Guatemala, the University of Panama, and the University of El Salvador. Given the several institutions and agencies that can be linked into the IPM project, it is important to recognize that national and regional research efforts provide reciprocal support for the genesis and implementation of effective crop-pest management systems in CA/P.

6. Research outputs

The IPM research team has an obvious responsibility to see that research results are utilized effectively and in a timely manner. Research data must be analyzed, interpreted, and compiled in annual reports for use in documenting progress and developing plans. These results should be shared freely among the IPM professional staff of the project, and, as appropriate, translated for non-technical use by farmers and other targeted beneficiaries of IPM

developments, and for development of training materials. The IPM scientists also should recognize the need for publication of research findings in recognized, referred journals, as these add scientific credibility to the work and enhance author and institutional prestige. The dissemination of research information also serves to document successes in achievement of the overall purpose of the IPM project.

C. Training

Development and implementation of effective IPM technology for the region requires an appreciation of the IPM philosophy and of how it should be applied to best effort. In CA/P this calls for a considerable training effort, focused on different levels of sophistication for different recipient groups. The key to this training is the availability of a cadre of knowledgeable IPM specialists who can organize and carry out the training component, and develop a broader base of IPM training expertise throughout the region.

The training components should address three levels: (1) specialized IPM training for project personnel, (2) public awareness and technical training of people associated with administration, extension, agribusiness, public health, and agriculture generally, and (3) academic and in-service training.

The training effort should be implemented through a program of short courses, seminars, and workshops:

1. Specialty training for project personnel

This should be approached through a 4-week workshop to acquaint project personnel with such topics as crop loss assessment, pest diagnosis, IPM methods, economics of IPM, pesticide management, etc. The specialty training is especially important as it can provide senior project personnel with capability to function as trainers for other instructional activities at CATIE and in-country.

2. Public awareness and technical training of individuals impacting agricultural practices in the CA/P region

This second level of training should be less technical and less comprehensive than the specialty training first described. It should involve short-courses, seminars, and workshops of relatively short duration (1 day-2 weeks), and will provide a basic understanding of IPM, pesticide management, and pest management economics. Participants should include administrators, research and extension personnel, teachers, agribusiness personnel, public health workers, Peace Corps volunteers, and others.

3. Academic and in-service training

At the present time, CATIE is not prepared to develop a graduate degree program in IPM, but it does have the capability of providing support of such programs through offerings of certain courses and thesis research opportunities. Existing arrangements with the University of Costa Rica to facilitate degree training may be extended to provide a more adequate mutual sponsorship of an M.S. program in plant protection.

In addition to the training activities just noted, the project should provide for procurement and development of training materials for use in IPM. An important consideration would be to ensure their availability in Spanish.

D. Technical Cooperation

The technical cooperation component should be designed to provide technical services assistance to support the regional IPM program.

Key elements in the technical cooperation component are pest diagnostic services, regional IPM information service, and technical assistance.

1. Pest diagnostic services

A prominent constraint to development and implementation of a regional IPM program is the lack of adequate diagnosis capability, and of adequately trainead personnel to provide diagnostic services in all of the CA/P. National diagnostic centers should be developed to provide in-country pest diagnosis and to offer pest identification training to national IPM practitioners. The national centers should maintain close linkages with CATIE.

2. Regional IPM information service center

This service should be supervised and coordinated by an information specialist, with responsibilities for developing an Information base, providing search and referral services, issuance of IPM newsletter, and assisting with training information management. The center should develop an improved capability in management of computer data bases for bibliographic information sources, and provide copy service and library loan assistance to requestors.

3. Technical assistance

This activity should provide specific technical assistance needed by project staff, national professionals, and national and private institutions. Technical assistancae can be provided on data analysis, report preparation, design of IPM projects, training, pesticides, and diagnosis.

Most of the technical assistance can be provided by the IPM specialists at CATIE, regionally-based IPM professionals, or outside consultants with special expertise.

E. Summary

The success of the CA/P integrated pest management project depends primarily on two factors: 1) the quality of the project staff selected and 2) the degree and quality of participation by national institutions and other personnel in the project. CATIE has a good record concerning both of these factors. Its experience and standards in staff selection and its decade of experience working with a wide variety of institutions in CA/P auger well for project success.

The project should focus on the development and implementation of improved technology for control of pests of the major food and cash crops produced on small farms in the region. Field activities of the project should be designed as an extension of the CATIE small farm production systems program, and involve the biological, economic, and environmental variables that interact in the overall crop-pest ecosystem. On-farm studies to research and validate promising IPM technology under small farm conditions are essential. A major question regarding project success is whether the results of the project will reach significant numbers of small farmers in CA/P. Realistically, highly promising research results will have little impact on small farmers unless extension agencies are effective in transmitting new technology. One focus of the training component of the project, should be on extension personnel, and thus their capacity to bring IPM technology to small farmers should be significantly enhanced.

The primary purpose of the project is institution building, especially in regard to strengthening the capacity of institutions to transmit the principles and practices of IPM to their constituency, be they farmers, agribusiness, students, or teachers. Chances for success in strengthening CA/P institutions' capacities in IPM are good.

In one sense, small farmers who use traditional methods of farming that have been passed down for generations are using cultural practices that have certain elements of IPM in them (i.e., polyculture, minimum or no-till practices, fallow, heterogeneous germplams, little or no fertilizer or chemical pesticides, etc.). The challenge of this project is to respect and preserve those practices which are sound and to improve those that are not. The feasibility of this occurring is high, especially with CATIE's extensive in-depth studies of and experience with small farmers.

Establishment of pest diagnostic services at CATIE and the participating countries should provide essential assistance to identification of pest problems in the region. This is supported by proposed development of a regional information service center at CATIE, with capabilities for bibliographic searching and literature retrieval, data storage, and information acquisition. The technical cooperation component also will provide a regional assistance program to make available technical expertise in project design, data analysis, and interpretation or help with special problems in IPM. The chances of success for the technical cooperation component of the project are judged to be high. Similar services in other regions of the world have been of great value to IPM implementation and the technical cooperation services proposed for the project are realistic and feasible.

The proposed actions promise to strengthen the CA/P region's capacity in crop protection and IPM, ensuring more favorable prospects for reducing pest losses, enhancing human health and welfare, and protecting the environment. The project is considered to be technically feasible and sound.

ANNEX I-G

INSTITUTIONAL ANALYSIS

A. CATIE

1. Objectives

The Tropical Agricultural Research and Training Center (CATIE) was founded June 1, 1973 by the terms of a contract signed between the Inter-American Institute for Cooperation on Agriculture (IICA) and the Government of Costa Rica. It is a nonprofit civil association, scientific and educational in nature, established to promote and stimulate research and technical cooperation in animal, crop, and forestry production, and to provide alternatives to meet the needs of the American tropics, especially in the countries of the Central American Isthmus and the Antilles.

The main objectives of the Center are:

- To conduct research for generating technology that will solve the agricultural problems of the tropical areas of Central America and the Caribbean, to benefit mainly the small-scale farmers.

- To train professionals from Latin America and the Caribbean at different academic levels, in order to provide specialists required by the countries to stregthen their national institutions and their agricultural development programs.

- To provide technical cooperation services to the countries, especially those of Central America and the Caribbean, working with them to strengthen their national institutions and to assist them in executing their agricultural research, training, and development programs.

2. Facilities and Personnel

The Center is located in the Turrialba valley, in the Atlantic watershed of Costa Rica, about 70 kilometers east of San Jose. The site was originally the headquarters of the Inter-American Institute for Agricultural Cooperation of the Organization of American States when it was created in 1942. When the General Directorate of IICA moved to San Jose in 1960, it maintained the site at Turrialba as a training and research center.

CATIE's facilities include four office buildings, a conference hall and other meeting rooms, classrooms, and teaching laboratories. There are also laboratories and facilities for soils, plant pathology, entomology, plant physiology, animal nutrition, and physiology, computer technology, and a meteorological station. Recently a new warehouse/workshop, tissue culture laboratory, and library were constructed. Equipment for the facilities is modern.

The center has 65 single and double dormitory rooms for students, 52 staff residences, and 21 apartments for housing visitors and families of graduate students and those attending short courses.

The Institution employs nearly 700 people, among the international and national professional staff, supporting staff and field laborers.

The total staff of CATIE includes approximately 110 university-trained personnel, including some 40 Ph.D.'s, several of whom are well known experts in their fields.

The central facility at Turrialba covers 1069 hectares: 266 are devoted to crop research, 287 to animal production and 100 to renewable natural resources (including forestry). Another 396 hectares are devoted to buildings and residential and landscape areas with the remainder in commercial production and a reserve.

3. Organization

The first Contract subscribed to by the Costa Rican Government and IICA was revised in 1982, and both parties then signed a new contract at the end of the same year. It was ratified by the Legislative Assembly of Costa Rica in May 1983.

With the signing and ratification of the new twenty-year Contract, the Center underwent a structural change in its organization. The Inter-American Board of Agriculture of IICA met as the Constituent Assembly of CATIE.

CATIE's membership now includes Costa Rica, Panama, Nicaragua, Honduras, Guatemala and the Dominican Republic. El Salvador is in the process of joining CATIE. The Governments of Colombia, Mexico and Venezuela are taking steps to become members.

The new contract made it possible for countries from outside the continent, as well as international entities, development

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agencies, foundations and others, to join the Center. Many of these, at present, have agreements with CATIE and provide technical and financial assistance.

The Center has its own Board of Directors, functioning as its highest executive body. The Technical Advisory Council, advisory body to the board, counsels the Board and makes recommendations concerning policies and strategies in the field of research, training, and technology transfer.

The Director is responsible for the Center's operations, and is elected by the Board members for a four-year term, eligible just once for reelection.

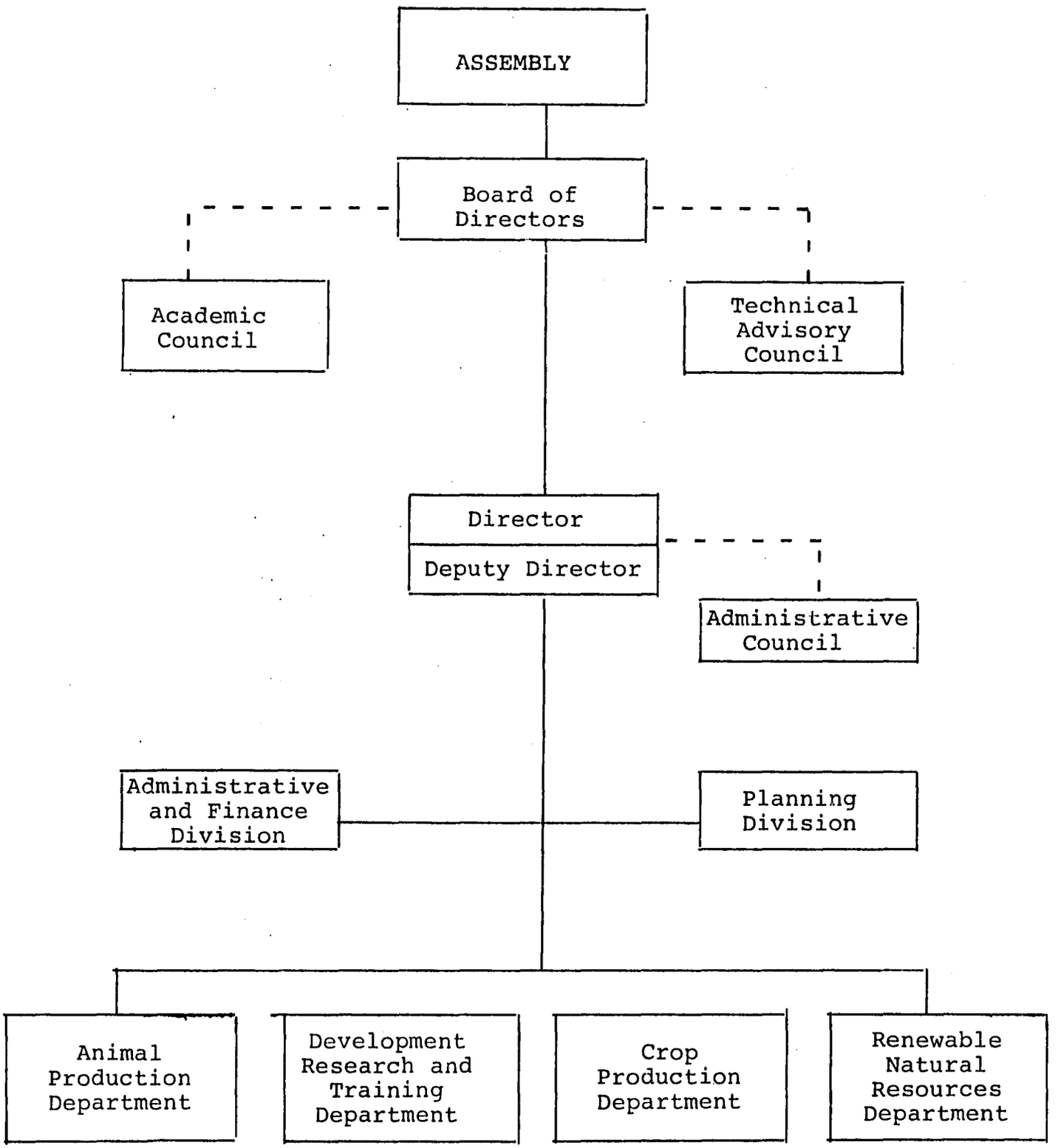
Other bodies established by the new Contract are the Academic Council, responsible for advising on the Center's educational activities and the Technical Administrative Council, an internal body set up to advise and to provide support to the Director's Office in technical, administrative and financial matters (See Organigram on next page).

To meet the established objectives, CATIE conducts its activities in four departments.

- Development of Resources for Research and Training (D.R.R.T. DPT.)

- Department of Animal Production (A.P. DPT.)

THE ORGANIZATION OF CATIE



- Department of Renewable Natural Resources (R.N. DPT.)
- Department of Plant Production (P.P. DPT.)

4. Financing

CATIE relies on contributions from member countries, IICA, and the International community in general for the majority of its core budget and operating funds. Some funds are also raised through the commercial sale of crops produced on the farm; however, the bulk of this income is from coffee and sugar sales which are currently low because of the depressed market prices for those commodities. At present, approximately 20 different groups from the international community provide funds.

As a non-profit organization, CATIE's objective is to match income with expenses while maintaining its ability to provide services to the region. Prior to 1981, CATIE continuously fell short of that objective. The result was a shaky financial picture which threatened CATIE's ability to function. Since 1981, however, the administration has placed top priority on strengthening the financial status of the institution. By means of an austerity program in which expenditures were reduced and measures to better control long-term costs were identified (with assistance from a ROCAP-financed contract with the local Price-Waterhouse representative) and implemented. As a result, CATIE has been able to eliminate the deficits of the previous years and operate at a level where income fully covers expenses.

5. International Cooperation

CATIE's activities aimed at benefiting the agricultural development in the American tropics have been considerably strengthened by the cooperation of the governments of several countries and of an appreciable number of international, regional, and national organizaitions.

Several countries contribute financial assistance and, numerous countries collaborate on specific projects. CATIE receives support from 54 institutions in Latin America and in other parts of the world through cooperative agreements which facilitate the exchange of technical personnel, genetic materials, and scientific information and technology.

CATIE also collaborates with the United Nations through the Food and Agriculture Organization, International Fund for Agricultural Development, and United Nations University.

6. Programs

a. Training

CATIE offers a Master's degree program through the technical departments, under terms of an agreement with the University of Costa Rica. The Center receives an average of thirty new students per year.

At another academic level, the Center offers short courses, seminars, and in-service training in special fields, both at its headquarters in Turrialba and in the member countries. In 1982, 1043 professionals from Latin America and the Caribbean received specialized training in different fields.

b. Research

CATIE conducts research on a wide range of topics. Problem orientated research is focused in four major areas: annual crops, perennial plants, animal production, and natural renewable resources. In addition, CATIE sponsors disciplinary support research in several areas. Important supporting resources are the different laboratories, such as the Tissue Culture Laboratory, where economically valuable species are propagated vegetatively, permitting the exchange of plant material with other regional and international research centers. The Soils and Plant Tissue Laboratory conducts chemical analyses of soil samples, making it possible to evaluate crop behavior in the field. The Plant Genetic Resources Unit has gathered a wealth of genetic material of important traditional and exotic crops in the tropics, that includes the Seed Bank with refrigerated chambers for seed storage.

CATIE's small farm production systems research program has been widely accepted and has significantly influenced the orientation of agricultural research in the region. The systems approach of the research considers the farm or production unit as a whole: the various interacting subsystems are developed in a defined ecological environment and influenced by particular socioeconomic conditions. The research is directed toward identifying and attacking the critical limiting factors and to find better systems that permit an increase in productivity.

c. Library and Information Systems

The Orton Memorial Library of the Inter-American Center for Agricultural Documentation and Information is located in a new building constructed with funds donated by the Overseas Development

Administration of the United Kingdon. Since it is one of the most complete in Latin America in the field of tropical agriculture, it provides ample support to the Center's diverse research and training programs. CATIE charges a service fee to handle the reproduction of technical material in the library.

The Experimental Methodology and Data Processing Unit, created in 1977, develops methodologies for working with experimental statistical information, extrapolation of information systems, analysis of data, and information banks.

7. Linkages with National Institutions

CATIE has cooperative project agreements with all Central American countries and Panama and collaborates with the MAG's and numerous agencies in the MAG's. The principal national agricultural research institutions in the CA/P region are: ICTA in Guatemala (Instituto de Ciencia y Tecnologia Agricola), an autonomous body; CENTA in El Salvador (Centro Nacional de Tecnologia Agropecuaria), together with extension and directly under the minister; INTA in Nicaragua (Instituto Nacional de Tecnologia Agropecuaria), together with extension in one autonomous agency; PNIA in Honduras (Programa Nacional de Investigacion Agropecuaria), directly under the minister; the General Directorate of Agricultural Research in Costa Rica, directly under the minister; and IDIAP in Panama (Instituto de Investigacion Agropecuria de Panama), an autonomous body. CATIE collaborates with these and a range of other national and regional institutions engaged in research and training, as discussed in other sections of this document.

B. CATIE'S CAPABILITY IN IPM

Since its creation, CATIE has engaged in a variety of activities related to crop protection and integrated pest management. Of the present CATIE staff, the following are crop protection specialists:

Alberto Beale, Ph.D., Weed Scientist

Jose Galindo, Ph.D., Plant Pathologist.

Joaquin Larios, M.S. (stationed in El Salvador), Plant Pathologist.

Raul Moreno, Ph.D., Plant Pathologist.

Joseph Saunders, Ph.D., Entomologist.

Tomas Schlichter, Ph.D., Ecologist/Vegetation Management Specialist.

Phillip Shannon, M.S., (Stationed in Panama), Entomologist.

The Center has published numerous articles on pests and pest mangement practices in the CA/P region. Joseph Saunders and a colleague have recently developed a book, to be published in Spanish and English by the Overseas Development Administration of the United Kingdom, on the insect pest of food crops in Central America. The book will be the most comprehensive ever published on the subject in this region.

Julio Henao, also of CATIE, and Saunders have developed a computer data base that contains data for about 1500 insect pests, 50 insect pest host plants, and 1000 literature references on these pests. The data base is an important beginning for the development of a region-wide comprehensive data base for all pests --insects, disease agents, weeds, etc., plus a range of subject matter related to IPM.

The CATIE staff routinely lectures on crop protection topics in the training programs at Turrialba. Some of the M.S. students have concentrated their research on various aspects of crop protection.

In 1979, CATIE and the Consortium for International Crop Protection (Berkeley, California) sponsored (at Turrialba) a short course on integrated pest management. CATIE has collaborated with the International Plant Protection Center (Corvallis, Oregon) on a variety of activities in weed management, including research and training.

CATIE does not presently have a comprehensive program in IPM, although the Center's farming systems approach has many elements of IPM in it, CATIE views IPM as a natural specialization of that approach. CATIE staff have expressed considerable interest in collaborating to develop and execute the regional IPM project. However, the present crop protection staff is insufficient to implement a comprehensive regional effort in IPM. Most are heavily committed other activities. Therefore, effective and credible project implementation is contingent on CATIE's ability to recruit additional staff to be assigned full-time responsibilities to the regional IPM project. Office space, housing arrangements, etc., will also be required.

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CATIE's well established infrastructure and capacity for research, training, and information management, as well as its linkages with each CA/P country, offer unique conditions for developing and implementing the regional IPM project. CATIE's existing network for international programs has already proven effective in the field of farming systems.

CATIE's regional character allows it to function relatively free of the economic, social and political constraints that usually affect national institutions, and gives the organization stability and continuity that national and bilateral projects often lack. Likewise, CATIE's location in a country free of many socio-political problems now affecting much of the Central American Isthmus further adds to the stability and continuity required for successful leadership.

CATIE can provide stability and continuity to national and bilateral IPM-related programs, and concurrently facilitate the horizontal flow of information, technology, and ideas through its information center. This regional effort will greatly widen the regional interest in IPM and stimulate the creation of new national and bilateral programs, which in turn will generate additional technology and interest in Central America and Panama.

With its vast experience in teaching programs, CATIE can generate IPM training at various levels to upgrade the quality and effectiveness of crop protection specialists in the region. Likewise, it can provide the necessary leadership and guidance in crop protection research and technical assistance.

CATIE would also benefit as coordinator in a regional IPM project. The project would serve to bolster CATIE's capacity in IPM and crop protection and make it better prepared for conducting research and training and offering technical assistance in these fields. Further, the research of the regional IPM project would evolve as an expansion of the on-going farming system program, therefore strengthening and widening this program.

C. CATIE'S LINKAGE TO AID PROJECTS

Several AID funded projects have been carried out by CATIE. CATIE has considerable experience in managing and implementing regional projects for ROCAP and is therefore familiar with AID's procedures concerning regional project development and management.

ANNEX I-H

ECONOMIC ANALYSIS

A. INTRODUCTION

Pest problems and their control have serious impacts on the viability of the CA/P agricultural sector. To develop and maintain the long term economic potential of the CA/P countries, improvements must be made in the management of agricultural pests.

This project is not designed to be an operational pest control program. Rather, it will develop the institutional capabilities necessary for improvements in agricultural pest control to occur. The following economic analysis is, in part, illustrative, and is based on the valid assumption that improvements in institutions capabilities will lead to the farm level benefits shown therein.

B. BACKGROUND

Agriculture contributes roughly one-fourth of the gross domestic product in Central America, and employs over half of the region's population. While modest increases in Central American agricultural output have been achieved in recent years, these increases have not been sufficient to sustain annual population growth. Import demand for food crops has increased annually for the past five years, even when local crops were good. Decreasing per capita food production and it's consequential increases in import demand represent a drain on foreign exchange and place the region in an increasingly vulnerable position. Improvements in local agricultural production capabilities are required to overcome these problems.

Pests affect agricultural potential both by causing large production losses and requiring important production inputs be devoted to pest control rather than to expansion of the area under production. Further, apparent increases in Central American reliance on pesticides for pest control exacerbate regional balance of trade problems.

The focus of this project is training, institution building, and applied research in integrated pest management (IPM). This will contribute to the human capital and knowledge base of the countries in the region. It will not result immediately in a stream of measurable economic benefits. Eventually, however, increased aware-

ness, local capabilities, and skills in IPM will reduce the impact of pests on agricultural production and result in improvements in the economic welfare of the region's population.

While this project is expected to yield some outputs that are ex-post economically quantifiable, the absolute magnitude of benefits cannot be quantified ex-ante with any degree of certainty. We cannot, therefore, demonstrate in absolute terms that the eventual stream of economic benefits will outweigh the costs of this project. Rather, we illustrate through case studies the manner by which economic benefits have accrued to similar endeavors, project the probability that this project will eventuate in comparable benefits, and conclude the economic benefits of this project are expected to far out-weight its costs.

The economic analysis first reviews and quantifies the importance of pest problems in Central AMerica. It proceeds by discussing the expected economic benefits of this project, presenting case study findings from similar projects, and concludes with a breakeven analysis of the project's economic outcome.

C. ECONOMIC CONSEQUENCES OF PEST PROBLEMS AND CONTROL IN CENTRAL AMERICA

The economic importance of pests and pest control in Central America is a function of three primary sets of factors: the production losses attributable to pests; the production costs incurred through efforts to control pests; and the macroeconomic and social costs of inefficient pesticide use. The relative importance of each of these factors varies by crop, farming system, and pest types. A larger proportion of production losses are attributable to insect and disease pests than to weeds, since actions are typically taken to control weeds where insect and disease diagnosis and control are less adequate. Production losses may be higher on basic food crops in small farming systems where fewer inputs are devoted to insect and disease control than is the case for cash crop production. Where pests' impacts on small farm food production costs are related to high labor requirements for weeding, production cost impacts of pests in larger cash crop operations are more related to excessive use of pesticides. Consequently, in the following sections, each pest impact is discussed separately for basic grain and cash crop production.

1. Crop losses

Systematic assessments of the value of crop losses to pests across Central America are inadequate. In fact, the limitations presented by this lack of information are directly addressed by the research objectives of this project. Despite the lack of documentation on the magnitude of specific pest problems, estimates of general crop losses to insects and diseases have been made.

For basic grains it is estimated that during the 1979-80 crop year, the five Central American countries collectively suffered preharvest losses estimated at 25 percent of potential bean production, 23 percent of potential rice production, 29 percent of potential maize production, and 26 percent of potential sorghum production, due to insects, nematodes and plant diseases. Postharvest losses to pests are estimated at an additional 15 percent each for maize and sorghum produced, and 20 percent each of rice and beans produced. application of these estimates to 1982 production and price figures provides a rough estimate of the current value of pest-related basic grain losses in the region (Table 1). The 172 million dollar etimated total represents the value of approximately 1.3 million metric tons per year of food grains lost to insect and disease pests under current conditions.

TABLE 1. Estimated Annual Pre and Post-Harvest Losses to Insect and Disease Pests of Basic Food Grains in Central America 1/

Crop	1982 Potential Production 2/	1982 Actual Production 3/	Potential less actual preharvest losses	Postharvest losses 4/	Sum of Pre and Postharvest	1982 Value of losses
	1,000 metric tons					million US$
Rice	509	392	117	78	195	28.3
Maize	4,376	3,397	979	360	1,339	104.4
Sorghum	462	342	120	51	171	12.8
Beans	317	238	79	48	127	26.5
TOTAL					1,832	172.0

1/ Includes Costa Rica, El Salvador, Guatemala, Nicaragua and Honduras.

2/ Calculated by adding to actual production the percentage pre-harvest losses attributed to insects and diseases.

3/ Sources: FAO and USDA Foreign Agricultural Service.

4/ Calculated by subtracting from actual production the percentage post-harvest losses attributed to insects and diseases.

5/ Calculated using average, fixed prices, 1982.

Since 75 percent of bean, maize, and sorghum, and 27 percent of rice production is contributed by the region's small farmers, the impact of inadequate plant protection on basic grains falls with disproportionate burden on small farms.

Although cash and nongrain food crops receive relatively more treatment for pest problems than do basic grains, production losses to pests of these crops also are high. For example, coffee yellowing disease currently causes a 20 percent loss in potential coffee production. Coffee rust and coffee bean borer are relatively new threats which have the potential to cause a 50 percent drop in production over the next several years. Losses to Black Sigatoka, a recently introduced, virulent, and rapidly spreading disease of banana and plantain are currently threatening Central America's $200 million banana production industry. Since plantain is a basic food item, banana production employs a significant portion of the region's labor force, and bananas are a major export good, the spread of this plant disease could have severe social and economic consequences. Cotton, tobacco, and specialty crops also are plagued by losses to insects and disease. Because Central AMerican cash crop market prices are highly responsive to changes in supply, and assessments of total losses to pests on these crops are not estimated, it is impossible at this time to place an absolute value on pest losses in CA/P cash crops. The relatively high per unit value of cash crops leads us to believe the value of regional pest losses in these crops is at least equal to the value estimated for basic grain losses.

2. Production Costs and Net Returns

Net returns to agricultural production are a function of production costs as well as yields. Production losses to pests would be far greater if some actions were not already taken to control pest problems. However, the pest control actions that are taken in CA/P represent a high proportion of agricultural production costs and are often used inefficiently, especially by small farmers. The result is suboptimal returns to these costly inputs.

The principal pest control input for small farm grain production is labor. Weed pests, in particular, incur high labor costs of food production in Central America. In small farm cropping systems, weed control is achieved primarily through hand weeding. Mandays for weeding has proved to be a significant factor in explaining yield variability in small farming systems. However, weeding operations occupy from 25 to 45 percent of the labor available for small farm production activities. Labor, far more than land or capital, is the limiting factor for small farm production. Each activity

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requiring labor restricts the area that can be cultivated by a small farm unit. Thus, the necessity to control weeds has a high opportunity cost.

Tables 2 and 3 are representative budgets for several regional small farm maize and bean operations respectively. The imputed value of family labor represents the majority (80 and 58 percent for maize and beans, respectively) of total variable costs, and weeding utilizes a large proportion of that labor in both cases. If labor requirements for weeding were reduced by 25 percent through introduction of more efficient weed management practices, a sufficient amount of family labor would be available to expand hectarage cultivated by approximately 5 percent for beans and 7.5 percent for maize. As area cultivated increases, small farmers' output, returns to labor, and net returns to production also increase.

Commercial cash crop operations are more capital intensive in their approach to pest control, but pest-related costs of production remain high. Approximately 12 to 17 percent of total (variable plus fixed) costs of banana production are derived from plant protection.

TABLE 2. Representative Budget for Small Farm Maize Production in Acosta, Costa Rica[1/]

OUTPUT	YIELD:	1,700 kg/ha
	PRICE:	4.49 C/ha
	GROSS VALUE:	7,641 C/ha

Inputs	Quantity per ha	Actual Payment, C/ha 2/	Cash Equivalent C per ha
Family labor, for:			
Land preparation	26 man-days	-	1,173
Planting	11 man-days	-	496
Weeding	23 man-days	-	1,038
Harvesting	11 man-days	-	496
All other activities	10 man-days	-	451
Hired labor	8 man days	361	-
Seed	20.3 kg	126	-
Fertilizer	91.0 kg	404	-
Pesticides	NR	12.3	-
Hired oxen	NR	5.6	-

Total Variable Costs of Production:
Cash and direct kind costs: 909 C/ha
Including all inputs at inputed costs: 4,564 C/ha

RETURNS
Net returns to land, family labor, management and risk: 6,732 C/ha
Net returns to land, management and risk: 3,077 C/ha

1/ Derived from information in: Platen, H. Von, G. Rodriguez, P. and J. Lagemann. 19892. Farming Systems in Acosta - Puriscal, Costa Rica. CATIE.
2/ Family labor valued at prevailing hired labor wage rate.

TABLE 3. Representative Budget for Small Farm Bean Production in Jinotega, Nicaragua[1/]

OUTPUT		
	YIELD:	518 kg/ha
	PRICE:	8.8 C$/ha
	GROSS VALUE:	4,561.8 C$/ha

Inputs	Quantity per ha	Actual Payment C$/ha	Cash Equivalent C$/ha2/
Family labor, for:			
Land preparation	17.2 man-days	-	458.8
Ploughing	11.6 man-days	-	309.4
Planting	8.4 man-days	-	224.1
Weeding	18.1 man-days	-	482.8
Harvesting	10.7 man-days	-	285.4
All other activities	1.6 man-days	-	42.7
Hired labor	16 man days	462.8	-
Seed	66.9 kg	563.2	-
Fertilizer	52.9 kg	176.5	-
Pesticides	NR	24.2	-
Hired oxen	NR	84.4	-

Total Variable Costs of Production:

Cash and direct kind costs: 1,275.1 C$/ha
Including all inputs at imputed costs: 3,078.3 C$/ha

RETURNS

Net returns to land, family labor, management and risk: 3,286.7 C$/ha
Net returns to land, management and risk: 1,483.5 C$/ha

1/ Derived from information in: Tienhoven, N. Van, J. Icaza and J. Lagemann. 1982. Farming Systems in Jinotega, Nicaragua. CATIE.

2/ Family labor valued at prevailing hired labor wage rate.

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Black Sigatoka control efforts in banana, alone, cost the CA/P region 100 million dollars per year. (This does not include the value of lost production.) Pest control costs on cotton in Central America represent from 25 to 45 percent of total production costs. If pest control inputs are used efficiently, their costs are justified by the increase in yield and net returns that result. However, if, as case studies indicate, pest control inputs are inefficiently applied, high production costs occur without generating adequate returns. Many of the expenditures on cash crop plant protection may represent net losses.

3. Import-Export and Balance of Trade

Balance of trade is affected by pest-related problems in two ways: the majority of pesticide products available for control are manufactured outside Central America and must be purchased with foreign exchange; pesticide residues in meat, shrimp, and vegetable products have restricted export possibilities, thus reducing the flow of exchange currency into the region.

Over 75 percent of pesticides used in CA/P are imported. The current value of pesticide importation into Central America is in the range of 125 to 150 million dollars per year. The majority of pesticides are used on cash crops. Table 4 shows the 1978 estimated value and distribution of materials by primary use.

Misuse of pesticides on crops grazed by livestock has reduced Central America's share in the meat export market. Exports of Central American beef and veal to the U.S. have declined annually from 1979, when 165,000 metric tons were exported, to 1983 when only 65,000 metric tons were exported.

TABLE 4. Estimated Value of Pesticide Use in Central America, 1978

PESTICIDE GROUP	VALUE AT 1978 DISTRIBUTOR SELLING PRICES (US MILLION $)	PERCENTAGE USE BY CROP	
Insecticides	130	Cotton	82%
		Rice	6%
		Other	12%
Herbicides	20	Sugar cane	32%
		Rice	25%
		Cotton	18%
		Bananas	14%
		Coffee	10%
Fungicides	15	Bananas	62%
		Coffee	10%
		Rice	5%
		Potatoes	5%
		Other	18%

SOURCE: UNIDO Report on the Use of Insecticides in Latin America

While much of the decline is due to a sluggish world market and low recent export prices for beef, the refusal of the U.S. to accept pesticide contaminated beef has also been an important factor. Exports of meat from Nicaragua to the U.S. were cancelled in 1979 because of high contamination with DDT and aldrin; El Salvador and Guatemala exports were cancelled in 1980 for the same reason; and Costa Rican meat was cancelled in 1982 for similar reasons.

The serious foreign exchange shortages currently faced in Central America suggest the region can ill afford over reliance on pesticides or the export restrictions imposed by unwise use of pesticides.

4. Other Costs

The environmental and human health effects of improper pesticide use are addressed through the pesticide management training and research components of this project.

The most direct impact of pesticide misuse on human health is pesticide intoxication. According to ICAITI, there were 14,138 reported cases of pesticide poisoning, and 40 deaths in Guatemala, El Salvador, Honduras and Nicaragua during the period 1972-75. The frequency of intoxication was found to be directly related to intensity of cotton production, a major pesticide using activity. Since pesticide use in CA/P has increased since the mid 70's, it is likely that current pesticide morbidity and mortality are as high or higher than the ICAITI estimates. A more recent report cites 120 deaths due to pesticides in 1982 in the single Chiriqui province of Panama (de Morris, Eunice C. 1984 "Estudio de Uso de Plaguicidas en el Distrito de Boquete." Natura, Vol. 4, No.1, Centro Regional Universitario de Chiriqui).

The costs of pesticide intoxication include the intoxicated individual's discomfort and ill-being, diminished efficiency of the working person, treatment costs (which in 1975 averaged $32.00 per case), and the value of lives lost. With the exception of documentated treatment costs, these costs are not readily quantifiable.

In addition to intoxication, pesticide use presents two other human health related costs. There are, first, the unestimatable hazards presented by long-term exposure to and storage in the body of persistant pesticides and their by-products. Secondly, insecticide use on crops has increased the rate at which insect vectors of human disease have developed resistance to insecticidal materials in the CA/P region. As resistance develops, costs are incurred in the

form of greater incidence of the vectored disease and higher required expenditures for attempts to control the vector with more effective materials. 1977 ICAITI estimates of the economically quantifiable social consequences of malaria vector resistance attributable to insecticide use on cotton in Central America were $8 million (1977 U.S. dollars) per year.

Less quantifiable are the environmental costs of poor pesticide management. Destruction of non-target bird, fish, and other wildlife populations and reduction in water quality are costs that depend on the value of environmental entities to the region's populace.

Social costs of pesticide use exist, to some extent, in all developing and developed regions where pesticides are used. The magnitude of these costs is relatively higher in Central America than in developed regions due to poor regional pesticide management. The value of these costs in relation to the benefits of pesticide use in CA/P also is high because of the relatively inefficient way that pesticides are employed in the region.

In Summary: A conservative estimate of the economically quantifiable impacts of agricultural pests and pest control in Central America is an annual cost of from $650 to $800 million. This includes lower-bound estimated values of actual and opportunity costs of controlling pests, production losses that occur despite control action, increased costs of malaria control brought about by mosquito resistance to insecticides used in agriculture, and treatment costs for pesticide intoxication. The estimated range does not include the value of foreign exchange losses, or non-quantifiable human health and environmental costs.

D. EXPECTED BENEFITS OF PROJECT IMPLEMENTATION

The pest-related economic problems reviewed above cannot be resolved until there exists in the region adequate knowledge and institutional capabilities to address them. Establishing these capabilities is a necessary first step towards realizing the potential economic benefits of improved pest and pesticide management. This project will accomplish that first step. It will further facilitate the transfer of knowledge into practice.

There are three levels at which project benefits will be realized. The direct beneficiaries will be the individuals and institutions whose capabilities are enhanced. As the knowledge gained by individuals and institutions is transferred to the ultimate target group, individual farmers will benefit from the increases in net

returns brought about by improved pest management. When a sufficient number of farmers have adopted the IPM approach, society will benefit from the aggregate effects of increased agricultural production and safer and more efficient use of pesticides. The likelihood of diffusion and adoption is addressed by the Social Soundness Analysis. Estimated benefits are discussed here by type of benefit and level of beneficiary.

1. Primary Benefits of Training

Training provided or supported through the project will directly benefit the trained individuals by increasing their wage and employment opportunities within the region. It is expected that approximately 19 students will receive advanced degrees in Plant Protection during the project period as a direct result of support provided through project implementation. This graduate training is not likely to occur before 1990 without the project. The current average regional wage differential between a B.S. level agriculturalist and a M.S. degree holder is $6,900 per year; and between M.S. and Ph.D. degree holders, the differential is about $15,000 per year. The present discounted value of increased earning capacity for the 19 degree earners is roughly $751,000 (see Table 5). Professionals and practitioners receiving specialized training through the project will also realize increased earning potential, with present value of these benefits assumed to approach an additional $250,000.

TABLE 5. Estimated Increased Earnings of Project-supported M.S. Graduates over 30-year Post-graduate Work-Life.

Years from Initiation of Project	Estimated Number of New M.S. Graduates Produced	Number of Accumulated Graduates	Value of Annual Wage Increases Summed Across Accumulated Graduates	Discounted (at 12%) Value of Annual Wage Increases
			----------U.S.$----------	
1	0	0	0	0
2	0	0	0	0
3	1	1	6,900	4,913
4	2	3	20,700	13,165
5	3[a]	6	57,600	32,659
6	5[a]	11	108,300	54,908
7	8	19	163,500	73,902
8	(none additional,	.	.	66,054
9	as direct result	.	.	59,024
10	of project)	.	.	52,647
11		.	.	46,925
12		.	.	42,020
13		.	.	37,442
14		.	.	33,518
15		.	.	29,921
16		.	.	26,651
17		.	.	23,871
18		.	.	21,255
19		.	.	18,966
20		.	.	17,004
21		.	.	15,206
22		.	.	13,571
23		.	.	12,099
24		.	.	10,791
25		.	.	9,647
26		.	.	8,666
27		.	.	7,685
28		.	.	6,867
29		.	.	6,050
30		.	.	5,396
Present value of increased wage potential =				$ 750,823

a/ 2 new graduate = Ph.D. level.

2. Economies of Scale

The regional nature of the project's technical cooperation component will achieve significant economies of scale. This is especially apparent in its data base and information management activity. The fixed cost of establishing a data base/information system total approximately $400,000 (U.S.). Once the system is established, the marginal costs of transmitting information to or collecting information from additional areas or individuals are very low. If each CA/P country were to establish its own system, the total fixed costs of data base/information management would equal over $2 million. The cost per item collected or transmitted would be high because the area and number of users over which the costs of each national system would be spread is much smaller than the regional audience. This project, by building upon and expanding existing regional data base/information systems, will realize economies of scale by serving the same, or a greater number of individuals resulting from the sum of national audiences, at a fraction of the fixed cost of separate, independent systems' establishment. Under the assumption that the regional audience served totals 5,000 users, fixed costs per user are estimated to be 95 percent lower for a centralized regional data base/information system than for decentralized, national systems. Similar economies of scale may derive from the regional pest diagnostic center on which the entire region may depend for diagnosis of problems individual countries are unable to address.

3. Secondary Benefits to CA/P Farmers and Society

The successful transfer of IPM technology to farmers and other pest control practitioners from effective trained individuals through functionally improved institutions, will yield benefits in the form of:

- reduced crop losses to pests;
- increased production and/or decreased production costs;
- increased farmer income; and
- increased safety and effectiveness of pesticide use.

Because this project will achieve the conditions prerequisite to IPM technology transfer, these benefits of IPM adoption will be more likely and more pervasive with the project than without it.

The mechanisms through which the transfer of IPM knowledge and skills will benefit the region's agricultural sector are reviewed below.

a. Increased Yield of Basic Grains

Current basic grain yields in most areas of the CA/P region are extremely low. Insect and disease problems are cited as one of the four principal factors explaining low regional yields. An analysis of factors contributing to maize yield increases in a test area of La Maquina, Guatemala indicates 47% of observed increases were due to improved control of insects. Insect and disease losses, despite their magniture, typically are tolerated by small farmers who do not have knowledge of system compatible plant protection strategies. Thus, transfer of validated research results and participation of selected farmers in the development and testing of appropriate IPM strategies will reduce crop losses to pests and, consequently, increase yields.

b. Decreased Agricultural Production Costs

The excessive labor input curr[illegible] [illegible]evoted to manual weeding operations on small farms is likely [illegible]e reduced by IPM strategies relying on cultural practices an[illegible] [illegible]elective herbicide use. Cash crop production costs can be significantly reduced by extending to farmers the knowledge required to avoid unnecessary pesticide application (see Case Studies).

c. Increased Farm Income

Yield losses to pests, in combination with high and/or inefficient production costs engender low net returns to farmers. Since basic grains are the life base of small farmers, even slight increase in yield have considerable potential for increasing income. Any project output that reduces post-harvest losses to pests will further supplement farm families' income by protecting their "savings". Since labor is the limiting factor for small farm production opportunities, a considerable increase in net returns to small farming operations requires plant protection techniques that increase production and/or reduce labor requirements without necessitating high initial cash outlay. Such techniques are consistent with the IPM approach described under Project Description. Thus, if the project is successful in developing and extending appropri[illegible] IPM strategies, net farm income is likely to increase to some ext[illegible].

d. Decreased human health and environmental costs of pesticide use

This benefit will directly result from training, educational material and public relations in the area of pesticide management.

e. Improvement in CA/P foreign exchange earnings

Improvements in this area are more likely to develop as an offshoot of better pesticide management than as a result of changes in the quantity of pesticides imported into CA/P.

In summary: While improved pest management will neither recapture all crop losses to pests nor eliminate the private and social costs of pest control, there is obvious untapped potential for improvement in the net economic consequences of pest related activities in the CA/P. The following case study development provides some indication of the extent to which benefits may be expected to accrue under the assumption of successful transfer of IPM awareness and technologies developed through this project.

E. CASE STUDIES

1. Preface

Numerous case studies on production systems ranging from orchards in Canada, small grains in the American Great Plains and cotton in Mexico, through sugar beets in England to sugar cane in Trinidad and rice in the Phillipines (to name but a few) have consistently demonstrated that application of the IPM approach increases yields and/or decreases production costs. Unfortunately, the results of these case studies cannot directly be extrapolated to Central American small farming systems. While they can be cited as evidence that IPM does in fact achieve economically superior pest control, the effects observed from each are specific to the production system in which they occurred. This specificity is one of the strong points of IPM. Integrated pest management in developed, capital intensive cropping systems has tended to correct the economic problems resulting from overreliance on and uneducated use of pesticides. In developing systems, such as the Central American small farm, IPM will act as much as a preventative measure for pesticide problems as a prescriptive remedy for pest problems.

The vast majority of IPM experimentation, development, and practice in Central America has occured on cotton. Due to their regional significance, the results of several of these efforts are reviewed below.

2. Integrated Pest Control Demonstration Program

This program was a component of a joint National Academy of Sciences (NAS)/ICAITI study of the environmental and economic conse-

quences of pesticide use in El Salvador, Guatemala, Honduras and Nicaragua, sponsored by the United Nations Environmental Programme, and conducted 1974-76.

The demonstration program was conducted in farmers' fields in each of the four countries. The IPM approach demonstrated relied first on biological, cultural and mechanical control of major cotton pests, with pesticides applied only when field conditions suggested the applications were economically justified. All agricultural activities on the demonstration plots, and on associated check plots, were monitored, and statistical comparisons of economic and organic variables were made.

The two-year average yield for IPM demonstration areas was 3,359 kgs. of seed cotton per hectare with 15.25 pesticide applications, on the average. Comparison fields using traditional control had yields of 3,038 kg/ha and received about 25 applications. Integrated pest management obtained yields 11% higher and made 39% fewer pesticide applications.

Detailed descriptions and findings of the Integrated Pest Control Demonstration Program may be found in ICAITI's 1977 Report, "An Environmental and Economic Study of the Consequences of Pesticide Use in Central American Cotton Production". Tables 6 and 7, reproduced from that report, show the relative profits obtained with the use of IPM were equal, or in most cases, superior to those obtained on conventional plots.

While this case study does not strictly apply to small farmers, it clearly illustrates the potential yield and net return increases that can be obtained from the application of IPM in a Central American cropping system.

TABLE 6. CENTRAL AMERICA: RESULTS OF INTEGRATED PEST CONTROL DEMONSTRATION, 1974/75

COUNTRY	Size of Plot (ha)	Number of treatments	Yields (kg of seedcotton)	Control/cost ($/ha)	Control/cost per kg.	Control/cost ($/ha)	Total Costs ($/ha)	Profits ($/ha)	Relative Profits (profit/cost %)
EL SALVADOR									
Integrated Control	47.6	19	3500	266.74	0.076	660.73	497.57		75.3
Conventional plot	42.0	21	3020	304.13	0.100	691.55	308.02		44.5
GUATEMALA									
Integrated Control	36.7	10	2594	194.36	0.075	687.94	170.06		25.0
Conventional plot	58.1	27	3567	410.55	0.1151	946.33	233.42		25.0
Integrated Control	25.2	12	1628	183.68	0.1129	623.73	- 94.34		- 14.9
Conventional plot	37.7	19	1680	261.29	0.1552	741.56	- 185.57		- 25.0
HONDURAS									
Integrated control	130.2	21.4	3385	304.72	0.090	724.07	396.05		54.7
Conventional plot	329.0	24.0	2140	261.00	0.103	755.04	- 47.19		- 6.00
NICARAGUA									
Integrated control	14.0	11	2983	180.39	0.060	829.61	157.09		18.90
Conventional plot	14.0	17	2933	229.20	0.073	878.42	108.28		12.30
Integrated control	260.4	12.4	3761	260.14	0.073	868.21	375.89		43.00
Conventional plot	245.0	18.0	3243	347.06	0.107	960.87	111.62		16.60
AVERAGE CENTRAL AMERICA									
Integrated control	85.6	14.3	2975	231.67	0.081	733.88	250.39		33.67
Conventional plot	121.0	21.0	2764	302.29	0.109	828.96	88.10		11.23

NOTE: To estimate profits, seedcotton prices of US$0.33 per kg. were assigned.
SOURCE: ICAITI

TABLE 7: CENTRAL AMERICA: YIELDS AND PESTICIDE APPLICATIONS IN INTEGRATED CONTROL PLOTS AND CHECK PLOTS IN TWO SUCCESIVE YEARS,

1974/1975 AND 1975/1976

COUNTRY	1974/75		1975/76	
	kg/ha seedcotton yield	Pesticide applications	kg/ha seedcotton yield	Pesticide applications
EL SALVADOR				
Integrated control	3502	19	2727	14
Traditional comparison	3022	21	2856	24
GUATEMALA				
Integrated control	2594	10	3895	13
Traditional comparison	3567	27	3895	35
HONDURAS				
Integrated control	3385	21.4	3376	16
Traditional comparison	2140	24	2337	24
NICARAGUA				
Integrated control	2761	12.4	3636	16
Traditional comparison	3243	18	2246	27
CENTRAL AMERICA				
Integrated control	3310.5	15.7	3408	14.8
Traditional comparison	2993	22.5	3048	27.5

SOURCE: ICAITI

3. USAID/El Salvador Cotton IPM Project

Similar results have been obtained through CENTA's USAID-funded cotton IPM project. Preliminary findings from that project indicate application of the IPM approach on small farms of cotton growers participating in the country's land reform program has decreased average pesticide use from 22 to 16 applications per year and cut production costs by 25 percent while maintaining yields at the same level as previously obtained.

F. Expected Returns to Project Investment

The case studies reviewed above provide a measure of the type of returns that can be expected from on-farm implementation of IPM on one crop in Central America. The same sort of positive effect of IPM on net farmer returns can be expected for basic food crops, but via a different mechanism. In the case of these crops, on which pesticide use is not intensive, the positive impact of IPM on net returns is more likely to come about as a result of significantly increased crop yields.

While improved pest management will neither recapture all crop losses to pest nor eliminate the private and social costs of pest control, there is obvious untapped potential for improvement in the net economic consequences of pest related activities in the CA/P. The very foundation of the IPM approach is that it aims to develop economically and environmentally appropriate pest control strategies. If we assume that the IPM training and research provided through this project will be applied in specific cases at the national level, we can expect to observe, as a result, quantifiable increases in farmer net return and measurable decreases in pesticide problems. This assumption is considered to be valid since project activities are focused on regional concerns and designed to promote the use of the IPM approach.

1. Breakeven analysis of project returns

Since the absolute value of farm-level impacts of IPM attributed to this project cannot be predicted, it is useful to determine how great those benefits would have to be in order to achieve a given level of returns to project investment.

The present value of anticipated total project costs is roughly $5.4 million (Table 8). A 15% internal rate of return on the project would yield adequate positive returns. The question, then, is: What magnitude of benefits, when discounted at 15% equals a present value of $5.4 million?

TABLE 8. PRESENT VALUE OF ANTICIPATED PROJECT COSTS

PROJECT YEAR	ACTUAL ANTICIPATED EXPENDITURES 1/	DISCOUNTED (12%) PRESENT VALUE OF EXPENDITURES
	$1,000 (U.S.)	
1	940	839.4
2	1,650	1,315.0
3	1,815	1,292.3
4	1,710	1,087.6
5	1,550	878.7
TOTAL	7,665 (actual)	5,413 (present value)

1/ For illustrative purposes. Includes ROCAP funds, plus anticipated contributions of CATIE and national institutions. This is a projection of total project costs. Costs per year may differ following budget negotiation and final financial agreements.

The expected present value of project training benefits is roughly $1 million. Reevaluating that benefit at a 15% discount rate yields a value of $693,000. Subtracting that from $5.413 million leaves a remainder of $4.72 million to be recouped by other benefits.

Using current, fixed prices, and assuming the majority of farm-level impacts of the project will be realized in the years immediately following formal, project termination, it is determined that any of the following levels of impact will achieve a 15% internal rate of return to the remainder:

-a 8.25 average, regional decrease in basic grain preand post-harvest losses to pests, spread over the 5 years following project termination, or

-a 10% average, regional decrease in the value of pesticides used on CA/P cash crops, spread over the 5 years following project termination, or

-a 1.4% average, annual increase in small farm net returns, spread over the 5 years following project termination

Table 9 shows the derivation of these figures. Since each of these represents a limited, very modest and highly achievable accomplishment of project goals, we conclude the project's benefits are expected to far outweigh its costs.

TABLE 9. BENEFITS THAT WOULD YIELD A 15% INTERNAL RATE OF RETURN

YEAR FROM PROJECT INITIATION	REDUCTION IN PEST LOSSES OF BASIC GRAINS 1/		REDUCTION OF PESTICIDE USE ON CASH CROPS 2/		INCREASE IN SMALL FARMER NET RETURNS 3/	
	Actual Value	Discounted (15%) present value	Actual Value	Discounted (15%) present value	Actual Value	Discounted (15%) present value
	U.S. $ million					
6	2.84	1.23	2.8	1.21	2.85	1.23
7	2.84	1.07	2.8	1.05	2.85	1.07
8	2.84	.93	2.8	.92	2.85	.93
9	2.84	.81	2.8	.80	2.85	.81
10	2.84	.70	2.8	.69	2.85	.70
TOTAL	14.2	4.74	14.0	4.67	14.25	4.75

1/ Assumes a 8.25% decrease in current $172 million value of losses, distributed equally over 5 years.

2/ Assumes a 10% decrease in current, ca. $140 million value of pesticides, distributed equally over 5 years.

3/ Assumes annual, aggregate net returns to CA/P small farmers is $1 billion, and returns increase a total of 1.4% over the 5 years.

ANNEX I-I

SOCIAL SOUNDNESS ANALYSIS

A. Introduction

This project's objectives directly address the need to build within the CA/P region a stable base of knowledge, expertise, and research capability in the area of integrated pest management. The ultimate beneficiary of improved regional capabilities in IPM is the CA/P farmer. It is the farmer and farm families who will benefit from the output of the research and assistance provided by local personnel trained and supported through the project.

The social soundness analysis first reviews the characteristics of the target farmer population. Following this descriptive narrative are analytical discussions focusing on three main themes: 1) the compatibility of the project with the sociocultural environment; 2) the likelihood that the results of the project will be diffused; and 3) the distribution of benefits from the project. In view of the regional nature of the project, the indicated themes will necessarily be discussed at two levels. That is to say, CATIE as the implementing institution for the project works directly with national institutions in the region; the latter institutions, in turn, have primary responsibility for linkage with the farmer. Diffusion of project results, for example, must therefore be viewed from the perspective of linkage between institutions in the region, and also the intra-national linkage between institutions of a given nation and the farmer.

B. Target Farmers

The research focus of this project is on pest management in cropping systems of the region's small farmers. The accepted regional definition on a "small farm" is one of size 30 hectares or smaller. According to CATIE, small farmers comprise about 64% of the farming population in the CA/P region, and produce 75% of all food crops in the region (except rice, for which 27% of regional production is contributead by small farmers). A large proportion of these farmers operate farms of under 10 hectares.

While the specific characteristics of the target small farmer vary among countries and crop production zones, several general features typify the CA/P small farmer. These are provisional farmers who have little land, little capital, and low educational levels. Many farm relatively poor quality land. Their operations are highly

labor intensive; well over 50% of variable production costs involve cash or opportunity costs of labor. Almost all work is done manually and nearly all labor is provided by the farm family. There is a seasonal farm labor shortage in the region. Small farmers can neither compete with the high wages offered hired laborers by commercial operators, nor handle increased hectarage with family labor. Few capital inputs are used. Less than 20% of costs are cash costs, although credit is available and relatively easy to obtain. Even with maximum amounts of obtained credit, the availability of cash at any given point in time for production input purchase and family use is low. The limits of cash in relation to family needs creates a constantly tight financial situation. Cash flow and labor are limiting factors to these farmers' production opportunities.

Small farm operators CA/P are characterized by mixed farming of crops and animals, combinations of perennial and annual crops, intercropping, and traditional methods designed to reduce risk. Basic grains (including beans) comprise a major portion of cultivated crops. Basic grain production is supplemented by production of other food crops and some cash crops. Approximately half of production is sold; half is consumed on farm or stored for later sale. Small farmers face poor market and physical infrastructures.

A complex of insects, plant diseases, weeds, and vertebrate pests reduce the yields of crops that form the major cropping systems for small farmers. Pest control practices of small farmers vary considerably by location, cropping systems, and resources available to farmers of small land holdings. Ordinarily, the small farmers do not use pesticides on food grain crops because pesticides' costs are excessive in relation to the value of those crops and the cash flow requirements of the farm family. Pesticides are used on less than 10% of small farm maize, bean, and maize/bean cropping systems, regionwide. Exceptions occur in some areas, such as areas of Guatemala where hybrid maize is produced and is generally protected with seed foliar and insecticide application. A more typical case is represented by the large number of small farmers growing basic grains and coffee in Honduras, of whom only seven percent use pesticides. Rice grown on small farms is more likely to receive herbicide treatment than are maize and beans. Vegetables, fruit, and specialty crops produced for sale, cotton, and other cash crops grown by small farmers are extensively treated with pesticides. But these make up a small and highly valued proportion of small farm production. The majority of crop protection practices on the small farm are cultural and mechanical. Weeding, in particular, requires enormous labor inputs. Approximately 45% of operating

costs and 50% of all labor inputs are devoted to weed control in small farming systems of the low humid tropics. In the dry-humid tropics, where weeds are somewhat less troublesome, weeding still requires labor inputs of from 15 to 30 man/days per hectare for maize, maize/bean, or sown bean production systems. Given the importance of labor as a limiting factor for small farmers' opportunities in Central AMerica, the demand placed on labor by pest control requirements is a significant impediment to the development potential for small farm agriculture.

C. Compatibility with the Sociocultural Environment

The research proposed under this project will largely, though not exclusively, utilize the on-farm research mode which CATIE has developed in recent years. This approach stresses the analysis of existing production systems, diagnosis of problems within those systems, and design of solutions to the problems identified. As a consequence, the newly introduced technologies are designed to cause minimal disruption to existing production patterns. Particular attention is paid to the demands placed on the farmer by the several crops and other enterprises typically part of the mixed-farming engaged in by small farmers in the region. This would include labor demands, cash flow constraints, and farm family needs for disposable income. In short, the choice of the farming systems research mode gives considerable assurance that research results are not only appropriate to the technical problem at hand but also appropriate to the sociocultural context in which those research results are to be employed. Two further points deserve mention. First, it is the case that farmers involved in the experimental work are volunteers, as are the additional farmers who try out the new technology in the validation phase of the research process. Second, the goal of the research on integrated pest management proposed here is to reduce the existing tendency to depend extensively on the relatively expensive and sometimes hazardous use of chemicals. Both points speak to the minimally disruptive nature of the intervention proposed in this project, as well as to the transferability of the resultant technology, to be discussed below.

At the level of interorganizational links, the project will again rely on the mechanisms CATIE has developed in playing its regional role, and the project is therefore again minimally Disruptive. The variety of institutional ties which CATIE utilizes in its work are described elsewhere in the project paper. Suffice it to say here that the outreach unit of the Plant Production Department is well on the way to institutionalizing the linkages appropriate to the farming systems research in the several countries in the region. This project will rely on those same linkages and can

serve to strengthen those ties as well as expand the network with its emphasis on pest management.

D. Diffusion of Innovations - the Spread Effects

It is not part of CATIE's mandate to directly engage in the extension of improved agricultural technology to farm audiences. CATIE relies on national extension efforts for diffusion to mass audiences. National entities become involved in the research and development effort in at least two ways. First, representatives of national institutions, including extension organizations, are instrumental in the process of selection of problems for research and in the selection of local situations for the conduct of on-farm research. This involvement ensures the selection of problems and target populations which are consistant with national priorities. By the same token the involvement of national entities in problem selection ensures an interest on the part of those same organizations in the widespread diffusion of research results. Second, national extension organizations are deliberately involved in the on-farm research process itself. Local extension personnel are only moderately involved in the on-farm experimentation phase of research, but become more extensively involved as experimental results are validated by trial under farmer management. Extension personnel are thus given first-hand experience with new technologies as they are developed, and they also gain experience with farmer reactions to those technologies. The stage is thus set for more widespread diffusion.

Direct farmer involvement in the farming systems research process has been mentioned previously. A small number of volunteers (6 to 10) are selected for the on-farm experimental work at a given site, and a larger number of volunteers (20 to 30) are selected for the validation phase of the work. Diffusion of research results beyond that set of farmers becomes the responsibility of the national entities. To this point CATIE researchers have put relatively little emphasis on wider diffusion of improved technologies and this relative lack of emphasis stems from its regional mandate.

Nevertheless, the present project proposes to strengthen the validation phase of the on-farm research effort in two ways. First it is proposed that those farmers normally involved in the validation phase of the research be briefly surveyed one and two years after the research process has been carried out at a given site. The issue here would be continued use of the improved technology. Second, it is proposed that modest surveys be conducted in areas similar to that for which the technologies were designed, two years after the technologies have become available, to determine whether

broader spread effects have been realized. Given the necessarily site-specific nature of the technologies designed for use in the complex multi-enterprise systems used by small farmers in Central America, it is anticipated that follow-up surveys would identify needs for further adaptive research to enhance the transferability of research results.

The major impact which this project will have on the diffusion of technological innovations hinges on its emphasis on training. The training component of the project is described elsewhere. It will involve short courses, seminars workshops, and the like for a range of audiences. Researchers, extension workers, program administrators, and representatives of private industry will be included. In view of the sometimes rapid turnover of personnel in the institutions to be reached by the training, it is recognized that the training will have to be conducted on a continuing basis. The project design takes this fact into account with its emphasis on institutionalizing the integrated pest management approach in the region.

An additional aspect of the diffusion of research results which this project proposes to strengthen at CATIE, and in the region, is the matter of outreach to professional audiences outside the region. Research on the production problems of small farmers is going on in many countries. Communication links among researchers in different parts of the world remain weak. The inclusion of an information center as part of this project is a direct means of addressing this problem. The information center will play a significant outreach role to a variety of audicences. The proposed newsletter is directly relevant here. Another outreach function which this project will strengthen at CATIE is the publication of research results in more widely available archival sources (professional journals). It is note-worthy that of the 262 publications on cropping systems released by CATIE to date (Cumulative list No. 10, Crop Production Department, CATIE, 1983), just 28 are listed as having appeared in professional journals. Of the latter, just 12 have appeared in extramural journals. Strengthening of this type of outreach function would seem to have considerable potential.

E. Social Consequences and Benefit Incidence

The question as to who will benefit from this project must again be addressed at both the regional and organizational level and at the level of farmers and farm families. A primary purpose of the project is to strengthen institutions in the region in their ability to deal with pest problems. It is intended that the integrated pest management approach become established in the institutions dealing

with agriculture in the region. The primary beneficiaries of the project are, therefore, the institutions and organizations, in both the public and private sectors, concerned with agriculture in Central America and Panama.

The next beneficiaries of the project are farm families who will gain via enhanced production efficiency and therefore higher net farm incomes. In addition, farm families are expected to gain from the project through a reduction of the risks associated with the handling of pest control chemicals as improved pest management technologies are put into place.

It is important to reiterate here that CATIE views its crop production work to be directed specifically (though not exclusively) towards small farmers. This project similarly will be directed primarily to the pest problems faced by small farmers. The target populations identified by CATIE researchers may range from as low as 1 hectare to about 30 hectares in size, varying in average farm size according to the land distribution patterns in the several countries. It should be clear, therefore, that the intended long-run beneficiaries of the project are the small farmers of the region who represent the bulk of the region's farming population.

F. The Role of Women

Females over 14 years of age comprise 25-30 percent of small farm families. Women as well as men, and children as well as adults, are intended beneficiaries in that one objective of the project is to enhance the productivity of the farms which are the major source of income for small farm families. Any project-related reductions in exposure to pesticide materials with teratogenic or mutagenic properties will especially yield benefits to pregnant and nursing women and small children.

The employment and training opportunities provided by the project apply equally to men and women. Hiring decisions will be made strictly on the basis of qualifications without regard to race, religion or sex. All educational institutes participating in the project are coeducational.

G. Summary

The region's population as a whole should benefit from the project, though dramatic improvements could hardly be eaxpected from a single and relatively small project. Since something on the order of 75% of the region's food comes from the small farms of the region, increasing the productivity of the small farm sector should increase regional food supplies. Consumers have historically shared

in the benefits of increased food supplies through lower prices. Furthermore, again because most of the region's food supply stems from small farm production, the emphasis in this project on monitoring and reducing pesticide residues in farm products will enhance the quality of the food available in the region, improve the health status of the region's populace, and aid in the expansion of markets.

INITIAL ENVIRONMENTAL EXAMINATION

Project Location	:	Central America and Panama
Project Title	:	Integrated Pest Management
Project Number	:	596-0110
Life of Project	:	Five Years (FY 1984-1988)
IEE Prepared by	:	Dale Bottrell, CICP
IEE Reviewed by	:	Frank Zadroga, REMS Kevin Kelly, PDO
Date	:	March 29, 1984
Action Recommended	:	Negative Determination

Concurrence:

John R. Eyre
Acting Director, ROCAP

James S. Hester
Environmental Officer
Bureau for Latin America
and the Caribbean

ANNEX I-J

ENVIRONMENTAL ASSESSMENT OF PESTICIDE USE

A. Project Description

The project will support an effort to develop an increased regional and national capacity in crop protection and will help establish sound IPM programs aimed at decreasing the deleterious effects caused by pest organisms to selected cropping systems in the CA/P region as well as reducing human health hazzards related to improper pesticide use. Essentially an institution building activity, the project will include research focused on selected agricultural pests, identifying appropriate IPM practices, and promoting the IPM approach to control those pests. The research activities will be carried out by qualified professionals under carefully monitored conditions. Some of the research will involve the use of pesticides as an element of a total IPM program. In those cases, however, the research will be oriented towards determining the most appropriate use of pesticides while minimizing any potentially negative environmental impact. The project will also have a heavy emphasis on training regional and national personnel in IPM methodologies and will include promotional activities to increase acceptability and use of the IPM approach and create greater awareness of problems resulting from the misuse of pesticides. A final component of the project will involve the provisions of pest information and diagnostic services and the establishment of a regional information management center to organize and distribute technical information required to facilitate IPM research, training, and technology transfer in the CA/P region. Technical assistance provided on a short term basis will be able to assist on critical IPM related environmental problems and promote technologies to solve those problems.

B. Purpose of Environmental Assessment

This assessment of pesticide use in the project was prepared in accordance with USAID's Environmental Procedures (22 CFR Part 216) of Regulation 16 of the Code of Federal Regulations. Of the project activities, pesticide use represents the most potentially serious envorinmental hazard. this examination describes use of pesticides in the project and sets forth procedures to minimize the adverse effects, as specified under "Pesticide Procedures," Paragraph 216.3 (b) (1) (i).

Before describing pesticide use in the project, it is necessary to describe the environmental setting and the farming situation where the project activities are to be carried out.

C. Environmental Setting

The region of Central America and Panama is located in the western hemisphere between 8 and 18 degrees latitude north. It is bounded in the north by Mexico and in the south by Colombia. The Atlantic Ocean provides the eastern boundary, and thePacific Ocean provides the western boundary. The total land area is approximately 423,000km^2.

The Central American-Panama Isthmus lays within "the tropical strip." Altitude varies from 0 to 4211 m.

Approximately 60% of the total region lays in a basal tropical belt ranging in altitude from sea level to about 800 m. Only 32% of the Isthmus is located in the premontane belt which extends from 800 to 1800 m above sea level. Population density and the intensity of agriculture are greater in the premontane belt than in the basal tropical belt. The living zones comprise almost all of the tropical classification running from the "dry tropical zones" where the average annual rainfall varies from 500 to 1000 mm to the "wet-tropical zones" with an average yearly rainfall of over 6000 mm. The mean annual temperature varies from 28°C (83°F) along the Pacific lowlands to less than 6°C (32°F) in the mountains.

The chemical and physical properties of the soil are also varied. In practically all countries of the region, there are some fertile soils of volcanic or alluvial origin. However, poor or fragile soils predominate in all of CA/P. In some cases this is due to age, intense tropical weathering and/or parental material, in other cases soils have been degraded by excessive erosion and run-off. These soils generally not suitable for agriculture.

Agriculture is the primary economic mainstay in the CA/P region, as described in the Economic Analysis. More than half of the population and farms are found in the wet-dry tropics, even though the lowland humid tropics cover about 40% of the region. Production of perennial crops such as banana, cocoa, and African oil palm and beef cattle on the larger farms tends to characterize the farming systems in the lowland humid tropics. Small holdings may also produce cocoa and cattle in addition to plantain, fruit trees, root crops, and basic grains. Practices on small farms tend to be less capital intensive and more traditional. The principal food grain,

produced almost universally in the small holdings, is maize. Rice is traditionally produced by small holders but is also found in the larger farms which are more mechanized. Farming activities in the region tend to be continuous throughout the year. Labor requirement is intensive for most of the crops except beef cattle but the hired labor force is low.

Water may be an important limiting factor in agriculture in the semi-arid tropics. Rainfall patterns are usually erratic allowing one or two overlapping but short cropping seasons. Thus, agricultural activities tend to be concentrated in certain parts of the year with a storage of labor during the cropping season and high rural unemployment during the off season which may last up to six months. The rainfed farming system of this region depends on the production of drought resistant food grains, the most common of which are the adaptive cultivars of sorghum and maize. The small farms of the semiarid tropics produce food grains primarily for family consumption and may also produce family gardens, fruit trees, and livestock. The wet-dry tropics include the most favorable environment for agricultural production and human settlement. Most of the large cities of CA/P are located on the pacific scope with a consequent high demand for food and competing pressure for land and the need for appropriate technology. The farming systems in these zones are highly diversified and include both annual and perennial crops as well as livestock production. Going from the intermediate altitude to the highlands of the wet-dry tropics one finds that the favored perennial crops include plantain, coffee, fruit trees and sometimes sugar cane. Animal production also changes, from beef to dairy. Food crop production varies widely within the region and even on a single farm, with maize and beans almost universally produced. Sorghum and rice are more common at the lower altitudes. Farms of the higher altitudes are marked by production of vegetables, potatoes, and small grains such as wheat. In the wet-dry tropics, intercropping is common.

The region has extensive rivers, tributaries, river basins, and watersheds. This water resource is critical in agriculture, foresty energy, fisheries, and other types of development. It is of particular importance to the region to protect this resource from siltation (due to soil erosion) and chemical contamination. The use of mulches, minimum till practices, and other conservation practices that are being encouraged by CATIE's farming system program are some of the important safeguards that can be used in the protection of the region's water system.

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In many portions of the region, the soils are subject to degradation through erosion. Erosion results from the high rainfall, steep slopes, deforestation, and poor farming practices.

The Social Soundness Analysis of the Project Paper describes the characteristics of the human population in CA/P countries. Education is compulsary but years of attendance and percentage attendance vary, as reflected in the literacy rate of from a high of 90% in Costa Rica to a low of 30% in the rural areas of El Salvador. The educational level and literacy rate among the small farm population are widely varied not only within the region but within the countries.

D. Present Pesticide Use in the CA/P Region

The pattern of pesticide use in countries varies widely among crops and cropping areas. The heaviest use is on non-food crops such as cotton, cocoa, and coffee. Cotton is the most heavily treated crop. Approximately 80% of the insecticides consumed by CA/P agriculture is applied to cotton. Heavy use of insecticides on cotton in the CA/P region has led to some serious problems that were well documented in a report of Instituto Centroamericano de Investigacion y Tecnologia Industrial (1977) entitled "An Environmental and Economic Study of the Consequences of Pesticide Use in Central American Cotton Production." Insecticides have poisoned humans directly, caused significant contamination of foodstuffs, and led to the outbreak of secondary insect pests. Further, applications of DDT to control insect pests on cotton have so modified the surrounding mosquito breeding habitat (river tributaries, estuaries, etc.) that insecticide-resistant malarial mosquitoes have evolved and greatly increased their abundance. Traditional agriculture characterized by small farms, polyculture (growing of two or more crops simultaneously on the same field in the same year), local, unimproved varieties, little or no artificial fertilizers, pesticides, or other artificial inputs, and minimum tillage, is still practiced by many farmers in the CA/P countries. For these farmers, there are no organized methods of pest control; pests simply are tolerated or controlled intermittently by natural forces and rare pesticidal treatments. The farmers have access to limited capital and technology, many of them are illiterate, and they have virtually no knowledge of the benef or limitations of pest control practices.

However, high yielding varieties, irrigation, mechanization, fertilizers, and other modern innovations are being introduced into the traditional agricultural areas. Crop yields have increased, often significantly, and this has provided incentives to adopt other

crop improvement techniques that maximize yields. Parallel with these modern innovations, pesticides, particularly insecticides and herbicides, are being used more and more. An important objective of the project will be to develop programs in research, training, and technical cooperation that help to prevent needless growth of pesticide use on the region's crops and to encourage alternative IPM systems.

E. Proposed Use of Pesticides in Project

Pesticides will be used only in the research component in Small Experimental Plots and in carefully monitored farmer field demonstrations. Several factors may determine the kinds and quantities of pesticides used in the project: severity of the pest problems, cropping systems in question, economic resources of the collaborating farmers, etc. The materials will be tested and demonstrated as part of an IPM program only when and where needed. They will be used in the following two ways:

1. Experimental Use

Some pesticides will be applied by project personnel to crops growing in small experimental plots. Applications will be by back-pack sprayers utilizing appropriate quantities. The practices of good pesticide management will be followed, as specified later.

2. Demonstration on farmers fields

As the efficacy of certain pesticides is established on experimental plots, it may be desirable for larger scale demonstrations. The demonstrations will involve larger plots on farmers' fields. The applications will be made either by project personnel or by farmers. The project's pesticide coordinator (refer G. below) will be in charge of ensuring that the farmers are properly instructed and/or supervised concerning proper pesticide use.

Table 1 lists pesticides that are proposed for experimental and demonstration purposes. It may not be necessary to use all of the pesticides listed; in fact, it is almost certain that not all will be used in the project. Further, it should be noted that during the project other pesticides may be required. Use of pesticides other than those indicated in Table 1 will require the prior approval of AID/W before they are to incorporated in demonstrations activities. The project's pesticide coordinator will be responsible for obtaining that approval through ROCAP's ADO office. Experimental uses of other materials will not require prior approval, but the project's

pesticide coordinator (see G. below) will ensure that the manufacturers of the experimental pesticides provide toxicological and environmental data necessary to safeguard the health of project personnel and environment of the treated area. Further, treated crops will not be used for human or livestock consumption unless appropriate tolerances have been established by EPA or recommended by FAO and who and the materials are applied at rates and frequency that do not result in residues exceeding the tolerances.

An estimate of the total area treated in the Experimental and demonstration plots over the 5-year period is in the neighborhood of 1500 ha. The experimental plots will range from 10 to 100 m^2 and the demonstration plots up to 5 ha.

TABLE 1. PESTICIDES PROPOSED FOR USE IN PROJECT (continued)

PESTICIDES	ORAL LD_{50}	WHO TOXICITY CLASS	EPA REGISTRATION CATEGORY	CROPS TO BE TREATED[a]				
				MAIZE	BEANS	RICE	BANANA	PLANTAIN
Fungicides								
Benlate	10,000	III	General		X		X	X*
Carboxin (Vitavax)	3,820	III	General	X				
Daconil	10,000	III	General[b]		X	X*		
Maneb	6,750	III	General[b]		X		X	X*
Mancozeb Dithane-M45	8,000	III	General[b]		X*			
Oxycarboxin	2,000	III	General		X*			

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TABLE 1. PESTICIDES PROPOSED FOR USE IN PROJECT (continued)

PESTICIDES	ORAL LD_{50}	WHO TOXICITY CLASS	EPA REGISTRATION CATEGORY	CROPS TO BE TREATED[a]				
				MAIZE	BEANS	RICE	SORGHUM	CASSAVA
Herbicides								
Alachlor	1,800	II	General[b]	X	X			
Atrazine	1,780	III	General	X			X	
Bentazon	2063	III	General	X	X		X	
Diuron	3,400	III	General					X*
Glyphosate	4,300	III	General	X*	X		X*	
Linuron	4,000	III	General	X			X	
Metolachlor	2,780	III	General[b]	X	X*			
Propanil	3,130	III	General[b]			X		
2,4-D	370	II	General[b]	X		X	X	

TABLE 1. PESTICIDES PROPOSED FOR USE IN PROJECT

PESTICIDES	ORAL LD_{50}	WHO TOXICITY CLASS	EPA REGISTRATION CATEGORY	CROPS TO BE TREATED[a]					
				MAIZE	BEANS	RICE	SORGHUM	CASSAVA	PLANTAIN
Insecticides									
Phoxim	1,845	II	General	X*		X*			
Acephate (Orthene)	945	III	General		X				
Carbofuran (Furadan 5G, 10G)	(Tech) 11		Restricted[c]	X					X
Lorsban (Chorpyrifos)	97-276	IB	General[b]	X					
Carbaryl (sevin)	500	III	General	X	X	X	X		
Synthethic Pyrethroids (Decis)	128.5	IB	General			X*			

[a] For all uses indicated, residue tolerances have been established by EPA or recommended by FAO/WHO

[b] Wearing protective clothing recommended

[c] Only the 10G formulation of carbofuran is restricted

* No. EPA or FAO/WHO tolerances established. Materials to be applied to experimental plots only. Crop harvests not to be eaten or fed to livestock.

F. AID's Pesticide Procedures

When pesticides are to be used in AID projects certain actions are required to ensure that their use does not present an unreasonable hazard to the human population or the environment. This section describes the use of the pesticides in the project and sets forth how the project has adopted AID's procedures to minimize the adverse effects of pesticides. The use of alternative non-chemical methods of control will be encouraged whenever practical.

In this document the term "pest" includes any group of organism --insects, bacteria, viruses, weeds, nematodes, snails, slugs, birds, rodents, or others-- that adversly affect the production, preservation, or use of agricultural plants (including seed and planting stock) or harvested products. "Pesticide" is any chemical preparation used to kill, repel, mitigate, destroy, or stop the action of pest populations and includes the following: 1) insecticides (to control insects), 2) acaricides (to control mites), 3) herbicides (to control weeds), 4) fungicides (to control fungi, molds, etc.), 5) nematicides (to control nematodes-small roundworms), and 6) rodenticides (to control rodents).

1. EPA registration status of the requested pesticides

In the USA pesticides are registered by the Enviuronmental Protection Agency. the EPA registers a pesticide product in one of two categories: "restricted use" or "general use." A restricted use pesticide is available for purchase and use only by pesticide applicators who are certified by law; it presents a very high toxicity and/or environmental hazard. A general use pesticide, by contrast, is available for purchase and use by the general public. All but one of the pesticides requested in this project (carbofuran 10% granular) are of the general use category. In the case of 10% carbofuran granular, application will be by project personnel only.

2. The basis for selection of the proposed pesticides

The criteria for selecting pesticides for use in this project were a knowledge of their efficacy, human safety environmental compatibility, and acceptable residue tolerances. All of the proposed pesticides are known to be effective in the CA/P region or similar tropical areas.

Although many pesticides are commonly used in the region, often the small farmers and farm workers are not properly prepared to handle them. Sometimes they use materials from unlabealed

containers. Often they do not possess or use protective clothing or safety devices, and they careslessly handle the materials: for example, washing empty containers in the river.

The herbicide paraquat is now widely used in the CA/P region for weed control. Paraquat represents a high risk to humans. For example, if one swallows the concentrate, it can kill, and exposure to skin and eyes may cause problems. The risks of serious harm and even death from paraquat and other toxic pesticides are greatly increased when the materials are dispensed from hand or back carried knapsack sprayers such as are commonly used in this region. Paraquat is not suggested for use in the project. The herbicide glyphosate is recommended as one alternative. When applied in combination with a fertilizer urea at very low volumes with small droplets, it may be no more costly than paraquat and equal in effectiveness. It is much safer to use. There may be other alternatives to paraquat.

3. Extent to which the proposed pesticide use is part of an integrated pest management program

Reliance on pesticides alone is expensive, and heavy use of pesticides rarely give lasting control. Pests, especially insects, plant disease agents, and rodents, often become resistent to the pesticides through genetic alteration if these materials are used extensively. The development of resistant strains of pests in both agriculture and public health has serious consequences not only to the farmer but to the public at large. Previously effective pesticides may no longer control the pests. Resistance in the pest populations is most likely to occur in areas where sole reliance is placed on pesticides and the use is heavy.

Experience in many parts of the world has shown that the best way to avoid pest resistance and also to increase and sustain agricultural production is to employ a variety of tactics for control, including biologial, genetic, physical, and chemical methods integrated together on the basis of economic and environmental criteria. This approach is known as integrated pest management and is the underlying theme of the project.

All uses of peticides in the research component will be for purposes of testing and demonstrating the integration of these materials in IPM schemes. The general guidelines for IPM development and implementation that appear in Annex II-C show how pesticides fit into the total IPM program.

4. The proposed methods of application, including availability of appropriate application and safety equipment

The hand-operated hydraulic knapsack sprayer is popular in CA/P countries among small farmers typical of those who will participate in the project. Most foliar treatments (applications to the plant's leaves) are made with knapsack sprayers. Granular pesticides are generally broadcasted or dropped on specific areas. In the project, pesticides will be applied mostly by knapsack sprayers and the other hand-operated techniques presently used in the region.

The project will provide and enforce the use of all appropriate protective devices and clothing such as face masks, gloves, boots, and coveralls for the project personnel who will be applying the pesticides. It will be the responsibilities of the project pesticide coordinator, described below in G., to ensure that pesticides are transported, stored, mixed, applied, and disposed of properly as specified on the pesticide's label. The pesticide coordinator and the project personnel will enforce all recommendations, rates and frequency of application, time of application, and the number of days before harvest the pesticaide may be applied.

The pesticides should be stored in the original containers in a facility specifically designated for this purpose. The facility should be locked with keys assigned only to authorized personnel. A sign in Spanish and English reading "DANGER PESTICIDE STORAGE AREA" should be posted. Pesticides should never be stored near food, animal feed, animals, or drinking water. The storage place should be in an area protected from tropical storms and fire hazards.

Proper disposal of excess or waste pesticides or pesticide containers is very important.

Empty containers should never be reused - there is no practical method for removing all of the toxic residues!

Liquid containers should be treated as follows: empty the container's content into the spray tank, drain in a vertical position for 30 seconds. Refill the container 1/4 full, rinse, and pour into the tank, drain. Repeat rinsing and draining three times. P the rinse water in the sprayer. Punch several large holes in the container's bottom. Bury the container in a designated land disposal site on high ground away from water.

The containers and small quantities of leftover pesticides should be burried in pits in the soil about 1/2 m. deep. The bot-

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toms and sides of the pits should be lined with lime, carbon, or charcoal, or organic matter such as leaves, straw, and other plant debris. Any of these materials is a good absorbent and facilitates breakdown of the chemical. The pits should be refilled and mounded above ground level with the soil.

Empty paper containers and bags should also be buried in similar burial pits.

The project will initiate a number of training programs in pesticide management and safety both for project personnel and others, as described in the training component section of the Project Paper (III-D-3).

5. Acute and long-term chronic hazarads, either human or environmental, associated with the use of pesticides and measures available to mitigate the hazards

All pesticides are potentially hazardous to humans and the environment and should be treated with caution regardless of their relative toxicity. The potential health hazard of a pesticide depends on the toxicity and the amounts swallowed, absorbed, or inhaled. The relative toxicity of a pesticide can be found by examining its LD_{50} value which is the amount of the chemical necessary to kill 50% of the test animal population (usually laboratory rats). It is expressed in the weight of pesticide per unit weight of body (mg/kg) when swallowed (oral toxicity), or absorbed through the skin (dermal toxicity), or inhalated. The latter value, inhalation toxicity, is ususally expressed in parts per million per unit volume of air.

As a general rule the pesticides with the lowest LD50 values are potentially the most toxic to humans. For example, the ingestion of just a few drops to a teaspoon of a pesticide with an oral LD_{50} value of less than 50 might be sufficient to kill an adult person. An adult would probably have to consume 16 tablespoons or 1/2 kg or more of a pesticide with an oral LD_{50} of 5000 before dying.

There are exceptions. For example, rodenticides (rat poisons) might have low oral toxicity valued, but would be considered only moderately toxic to humans.

The World Health Organization has classified pesticide products into four categories of toxicity based on the LD_{50} values: IA extremely dangerous, IB highly hazardous, II moderately

hazardous, and III slightly hazardous. Nearly all pesticides in WHO's first two categories (IA and IB) are too toxic for general use. They are dangerous chemicals that should only be used by specially trained people and taking full account of the precautions indicated on the label of the pesticide's containers. Two pesticides (the insecticides chrolophyrifos and the synthetic pyrethroids) proposed for use in the project are in category IB (see Table 1). Acceptable alternatives that may be less hazardous cannot be identified at present. Chlorpyrifos and the synthetic pyrethropids will be used by project personnel only under closely supervised conditions, and an effort will be made to seek less hazardous materials.

6. The effectiveness of the requested pesticides for the proposed uses

The pesticides requested for use in the project have been evaluated under a variety of conditions including those of the CA/P region and found to be effective for the purposes intended in the project. However, the cost effectiveness of the materials has not been rigorously tested. One of the objectives of the pesticide research in the project will be to conduct acceptable cost/benefit analyses, as discussed below in H.

7. Effect of the proposed pesticides on the target and non-target ecosystems

The pesticides that are requested for use in this project are generally not persistent and, if used correctly and according to their labels, should present no unusual hazards to the target or natural ecosystem. Incorrect handling, such as applying higher dosages and at closer intervals than recommended on the labels, spraying during windy conditions, careless storage, improper disposal, or rinsing equipment and containers in rivers, would have harmful effects.

Most of the insecticides suggested are toxic to some of the natural enemies (beneficial predators and parasitic insects, for example), especially when applied at high rates, and some are hazardous to bees (carbaryl). Their use therefore would be expected to reduce pupulations of natural enemies and bees residing in tree experimental and demonstration plots.

The threat of buildup of genetically resistant strains of insect pests, plant diseases, weeds, and rats that cannot be controlled with pesticides that were previously effective always exists.

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Some of these problems are unavoidable when chemical pesticides are used. The best way to minimize the adverse effects is to use the pesticides in combination with other control tactics in IPM programs, and to educate users and other applicators of pesticides of hazards and proper use of the materials. The project will emphasize IPM and pesticide management and, through training and education on these subjects, will foster more rational use of the materials.

8. Conditions under which the pesticides are to be used including climate, flora, fauna, geography, hydrology, and soil

These conditions were described above under C.

9. Availability and effectiveness of other pesticides or non-chemical control methods

Most of the pesticides requested for use in this project, as well as others, are available through commercial outlets in the CA/P region.

Crop rotation and other non-chemical methods including use of clean, pest free planting material, destruction of diseased crop plants, crop residue destruction, and many other cultural practices reduce pest severity. This project is designed to develop and encourage use of these kinds of non-chemical control methods.

10. CA/P region's ability to regulate or control the distribution, storage, use and disposal of the requested pesticides

The responsibility for control of the distribution, storage, use, and disposal of the requested pesticides on this project will be the primary responsibility of the pesticide coordinator, described below in G. In addition, the laws governing pesticide management established by the various countries of the region will be observed by the project personnel. However, it is a well-known fact that while the CA/P countries have pesticide laws on the books they frequently lack procedures and personnel for proper enforcement of the laws.

Through training, seminars, and conferences, the project will serve to heighten the awareness in the region of the need for improved pesticide use and regulation. The project will sponsor both regional and in-country training for professionals including extension officers, health officers, pesticide applicators, and

others on pesticide management, including safety, monitoring, disposal, and regulations. In addition, several of the IPM training activities will address problems related to pesticide misuse thereby helping to reduce serious environmental and human health impacts which currently affect a large number of people in CA/P. Thus, although not directly targeted by this project, problems such as the excessive use of pesticides in cotton and veg crops or the contamination of coastal zones and fisheries by excessive pesticide runoff, will be able to be better dealth with through improved awareness and institutional capabilities.

11. The provisions made for training of users and applicators of pesticides.

Training in IPM and pesticide management for project personnel, university personnel, extension workers, and others will be emphasized. Short courses, seminars, workshops, and academic training will be implemented by the project, as described in III-D-3.

12. The provisions made for monitoring the use and effectiveness of the pesticides

The pesticide coordinator, described below in G, will monitor the use of pesticides in the project and ensure that they are being handled correctly and safely, as outlined in these pesticide procedures.

If necessary, the pesticide coordinator will facilitate pesticide residue analyses required for the establishment of residue tolerances. A residue tolerance is the amount (expressed in parts per million) of a pesticide that may legally and safely remain in or an any farm product to be eaten by livestock or humans. Many countries will not allow the importation of crop produce used for human food if the residue tolerance of that country is violated. Therefore, monitoring of residues resulting from the research and demonstration plots established in the IPM project will be a vital responsibility not only for the food used for local consumption but any that may enter export channels.

G. Appointment of Pesticide Coordinator

CATIE should designate the Entomologist of the Regional IPM Coordination Team to serve as "pesticide coordinator" to ensure compliance with the project's pesticide procedures as outlined above in F, 1 through 12. The pesticide coordinator will be responsible for ensuring correct distribution, storage, use, monitoring, and dispos-

al of pesticides used in the project and for implementing research, training, and other activities related to pesticide management.

It should also be the responsibility of the pesticide coordinator to ensure that all pesticides procured for use in the project meet the approval of AID's Pesticide Procedures.

H. Guidelines for Cost-Effective Use of Pesticides

When used appropriately, pesticides can provide enormous economic returns. When used inappropriately, they represent an economic liability, particularly for the small farmer. The basic rule of thumb for cost effective use of pesticides is that a pesticide be applied only if and when its costs (materials and application) are met or exceeded by the value of losses prevented by its use. Economic returns are maximized when pesticide materials are applied to pest population levels that cause an amount of loss equal in value to or greater than the added cost of using the materials. This pest population level is the minimum level that justifies treatment and, under usual farming conditions, is larger than some lower population level that causes measurable crop loss. Applications made to pest populations below this "threshold" level cost more than they save and thus are wasted investments. Small farmers with limited capital cannot afford to waste cash inputs.

Using pesticides cost effectively requires the capability to identify and monitor pest populations pesticide costs and at least a minimal understanding of the dynamics of crop-pest interactions. The pesticide user should know at what stages of crop development specific pests cause economic losses and at what growth stage pest populations are vulnerable to pesticides. Users must additionally be able to properly select, obtain, and mix pesticide materials, calibrate equipment, and correctly apply formulations. If the above sets of skills and knowledge are not possessed, pesticide materials may be applied in ways that yield little or no economic return to the pesticide investment.

While rigorous application of the economic threshold decision rule can rarely be achieved, adherence to the basic concepts underlying that strategy will improve the cost effectiveness of pesticide use. Basic understanding of the mode of crop pest damage and the requirements for appropriate pesticide application will maximize the cost-effective use of pesticides.

I. Potential Adverse Impact of the Non-Chemical Alternatives

Use of chemical pesticides has dramatized the point that any single control procedure can have unexpected and undesirable consequences. However, continued use of a single alternative method also may produce unexpected and undesirable consequences. The practice of plowing and cultivating, for example, may completely eliminate a perennial weed from a field, but an annual weed may in- vade the field and pose even more of a problem than did the target weed that was eliminated. The use of disease-resistant cultivars may eventually give rise to new strains of disease organisms capable of overcoming such resistance. Pest organisms are remarkably adaptive; the intense selection pressures imposed by human manipulation of their environments accelerate the evolution of new strains that adapt to and override control methods.

Development of effective, long-term solutions for pest problems require an understanding of the actions, reactions, and interactions of the components of the crop or other ecosystem to be protected. Change to a new variety, rotation to another crop, change in fertilizer, modified row-capacity, or irrigation schemes, and change in pesticide may drastically modify the status of pest species in a given ecosystem. The manipulations may reduce the numbers of a damaging pest, but they may also permit establishment of new damaging pest hierarchies. Even subtle manipulations affect the ecosystem. Only by studying these relationships can the pest control specialist devise ways to avoid ecological disruption and maximize the effectiveness of natural and artificial controls.

Therefore, the use of any alternative method must be carefully considered in an ecological context before being recommended to farmers or even before being tested on large scale.

Project personnel will pay particularly close attention to and take steps to mitigate environmental impacts when considering the following classes of alternative methods:

Biological control: Plant and animal quarantines and other regulations governing the shipment of plant materials (promising germplasm, weeds for the diagnostic services' herbaria, etc.) or live animals (insect parasites and predators for reference collections) in the region.

Cultural practices: Crop rotation, field sanitation and other cultural practices will be carried out in such a way that soil de-

gradation will not occurr through increased erosion on runoff nor through the excessive destruction of organic material and soil structure.

Mechanical Physical Control: Techniques utilizing fire and/or mechanical cultivation to control pests will be applied in unison with conservation practices that will prevent soild degradation.

J. Recommendation

Based on the above eaxamination of the use of pesticides under the project, it has been determined that sufficient controls will be in place so that any danger to the environment will be minimized. A negative determination is recommended.

IV. Impact Identification and Evaluation Form

Impact Area and Sub-Areas	Impact Identification Evaluation 1/
A. LAND USE	
1. Changing the Character of the land through	
a. Increasing the population	N
b. Extracting Natural Resources	N
c. Land Clearing	N or L
d. Changing soil character	L
2. Altering Natural Defenses	M+
3. Foreclosing important uses	N
4. Jeopardizing man or his works	M+
5. Other Factors:	
Reducing pesticide pollution and contamination	M+

1/ The following symbols were used:

N = No environmental impact

L = Little environmental impact

M = Moderate environmental impact

H = High environmental impact

U = Unknown environmental Impact

+ = Beneficial impact

- = Negative impact

B. WATER QUALITY

1.	Physical state of water	N
2.	Chemical and biological states	M+
3.	Ecological balance	L+
4.	Other factors	N

C. ATMOSPHERIC

1.	Air additives	N
2.	Air pollution	N
3.	Noise pollution	N
4.	Other factors	N

D. NATURAL RESOURCES

1.	Diversion, altered use of water	N
2.	Irreversible, inefficient commitments	N
3.	Other factors	N

E. CULTURAL

1.	Altering physical symbols	N
2.	Dilution of cultural traditions	N
3.	Other factors	N

F. SOCIOECONOMIC

1.	Changes in economic/employment patterns	M+
2.	Changes in population	N
3.	Changes in cultural patterns	N
4.	Other factors	M

G. HEALTH

1.	Changing a natural environment	N
2.	Eliminating an ecosystem element	N
3.	Other factors	
	Reduce pesticide poisoning	M+

H GENERAL

1.	International impacts (cooperation in pest management)	M+
2.	Controversial impoacts	N
3.	Larger program impacts	N
4.	Other factors	N

I. OTHER POSSIBLE IMPACTS (not listed above)

1.	Introduction of new plant species	N
2.	Agricultural chemicals	M+
3.	Other Factors	N

ANNEX I-K

Financial Analysis

TABLE 1

AID INPUTS BY CURRENCY UTILIZATION

($ 000)

	FOREIGN EXCHANGE	LOCAL CURRENCY	TOTAL
PERSONNEL	1,248.35	1,492.65	2,741.0
EQUIPMENT AND MATERIALS	327.05	113.95	441.0
TRAINING	272.6	673.4	945.0
TRAVEL AND PER DIEM	320.0	80.0	400.0
CONSTRUCTION	--	90.0	90.0
EVALUATION	90.0	--	90.0
PRINTING AND PUBLICATION	--	50.0	50.0
INFLATION AND CONTINGENCY	765.0	--	1,227.0
T O T A L	4,250.0	2,500.0	6,750.0

TABLE 2

IPM BUDGET SUMMARY
ROCAP CONTRIBUTION
($ 000)

ITEM	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5 ($1,000)	TOTAL	% OF PROJECT TOTAL
Personnel a/	265	724	804	671	277	2,741	41 %
Equipment & Materials b/	222	60	75	44	40	441	7 %
Training c/	33	199	255	227	232	946	14 %
Construction	90	—	—	—	—	90	1 %
Travel & Per Diem d/	30	100	90	90	90	400	6 %
Evaluation	—	45	—	—	45	90	1 %
Printing and Publication	2	15	9	9	15	50	1 %
Inflation + Contingencies e/	96	171	185	168	145	765	11 %
Overhead f/	164	292	315	269	187	1,227	18 %
TOTAL	902	1,606	1,733	1,478	1,031	6,750	100%

a/ Totals include a 5% across the board increase per year. Personnel Item does not include consultants hired for training purposes. See Table 3 for details.

b/ See Table 4 for details.

c/ Includes salary, travel and per diem for consultants hired on short-term basis for training purposes. See Table 5 for details.

d/ Travel and per diem for project staff only.

e/ 16% of all items, including personnel.

f/ 22.2% of all items, including inflation and contingencies.

TABLE 3

DETAILED PERSONNEL BUDGET - ROCAP CONTRIBUTIONS ONLY [a]

($ 000)

PERSONNEL ITEMS	YEAR 1 PM	YEAR 1 AMT	YEAR 2 PM	YEAR 2 AMT	YEAR 3 PM	YEAR 3 AMT	YEAR 4 PM	YEAR 4 AMT	YEAR 5 PM	YEAR 5 AMT	TOTAL PM	TOTAL AMT
Project Manager	12	60	9	47.25	6	33.1	3	17.4	—	—	30	157.75
IPM Specialist 1	6	27.5	12	57.75	12	60.6	8	43.8	—	—	38	189.65
IPM Specialist 2	6	27.5	12	57.75	12	60.6	8	43.8	—	—	38	189.65
IPM Specialist 3	3	13.75	12	57.75	12	60.6	8	43.8	—	—	35	175.95
Agricultural Economist	9	41.25	12	57.75	12	60.6	8	43.8	—	—	41	203.4
Internat.Professionals [b]	36	170	57	278.25	54	275.5	35	192.6	—	—	182	916.35
Information Specialist	12	13	12	13.65	12	14.3	12	15	12	15.8	60	71.75
Administrative Assist.	9	9	12	12.6	12	13.2	12	13.9	12	14.6	57	63.3
IPM Program Coord. 1 [c]	3	7.25	12	30.45	12	32	9	25.2	3	8.8	39	103.7
IPM Program Coord. 2 [d]	3	8.62	12	36.2	12	38	9	29.95	3	10.5	39	123.27
IPM Program Coord. 3 [e]	3	9.5	12	39.9	12	41.9	3	33	3	11.5	33	135.8
IPM Program Coord. 4 [f]	3	8.8	12	37	12	38.8	9	30.6	3	10.7	39	125.9
IPM Program Coord. 5 [g]	3	7.5	12	31.5	12	33.1	9	26	3	9.1	39	107.2
Research Assts.(4) [h]	12	14	48	58.8	48	61.7	36	48.6	12	17	156	200.1
Research Asst. (CR) [c]	—	—	12	13.65	12	14.3	9	11.3	3	3.95	36	43.2
Research Asst. (ES) [d]	—	—	12	16.6	12	17.4	9	13.7	3	4.8	36	52.5
Research Asst. (GU) [e]	—	—	12	19.95	12	20.9	9	16.5	3	5.8	36	63.15
Research Asst. (HO) [f]	—	—	12	18.9	12	19.8	9	15.6	3	5.5	36	59.8
Research Asst. (PA) [g]	—	—	12	14.9	12	15.7	9	12.3	3	4.3	36	47.2
National Professionals	48	77.67	192	344.1	192	361.1	144	291.65	66	122.35	642	1,196.87

TABLE 3
DETAILED PERSONNEL BUDGET - ROCAP CONTRIBUTION ONLY a/
(Continued)
($ 000)

PERSONNEL ITEMS	YEAR 1		YEAR 2		YEAR 3		YEAR 4		YEAR 5		TOTAL	
	PM	AMT	PM	AMT	PM	AMT	PM	AMT	PM	AMT	PM	AMT
Biling.Secretaries(3) h/	21	10.2	36	18.1	36	19	36	19.9	36	20.9	165	88.1
Secretaries (5) i/	15	4.8	60	20.3	60	21.3	45	16.8	15	5.9	195	69.1
Technicians (4) h.	--	---	15	9.6	48	32.2	48	33.8	30	22.2	141	97.8
Support Personnel	36	15	111	48	144	72.5	129	70.5	81	49	501	255
Short Term Consultants	--	---	NA	45	NA	85	NA	106	NA	96	NA	332
Part Time and Temp. Personnel	--	2.33	NA	8.65	NA	9.9	NA	10.65	NA	9.25	NA	40.78
Total Personnel	120	265	360	724	390	804	308	671.40	147	276.60	1,325	2,741

a/ Includes salary and benefits for all project staff. Does not include consultants hired for training purposes (These are under "Training", within the "Workshops and Seminars" item). A 5% annual wage increase is built into each staff line item.

b/ All international professionals located at CATIE.

c/ Located in Costa Rica.

d/ Located in El Salvador.

e/ Located in Guatemala.

f/ Located in Honduras.

g/ Located in Panama.

h/ Located at CATIE.

i/ Located in-country.

TABLE 4

DETAILED EQUIPMENT AND MATERIALS BUDGET
($ 000)

ITEM	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	TOTAL
Computer Equip. & Supplies	60	10	5	2	2	79
Laboratory Equipment	14	7	7	7	5.6	40.6
Laboratory Supplies	6	3	3	3	2.4	17.4
Audio Visual Equip. & Supplies	20	8	2	2	2	34
Pesticide Application and Safety Equipment, and Materials	3	5	2.5	2.5	2.5	15.5
Vehicles	98	--	28	--	--	126
Equipment parts, service, and Maintenance	1	7	10	12.5	13.5	44
Postage	2	10	7.5	5	2	26.5
Reference Material, Office Supplies & Misc.	18	10	10	10	10	58
TOTAL	222	60	75	44	40	441

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TABLE 5

DETAILED TRAINING COSTS BUDGET
($ 000)

ITEM	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	TOTAL
15 CATIE scholarships (M.S. degrees)	10	30	60	120	80	300
11 Specialized study tours	10	15	20	10	--	55
Workshops and Seminars	--	129	150	75	130	484
Textbooks and training materials	10	15	5	2	2	34
Miscellaneous	3	10	20	20	20	73
TOTAL	33	199	255	227	232	946

TABLE 6

CATIE CONTRIBUTION

		PM	AMOUNT
I.	PERSONNEL		
	Project Manager	30	173.95
	IPM Specialists	48	260.25
	Economist	16	86.75
	Research Assistants	48	67.20
	Sub-Total		588.15
II.	TRAINING		50.00
III.	OTHER		
	Research Sites		61.0
	Information System		25.45
	Diagnostic Services		25.4
	Sub-Total		111.85
	T O T A L		750.0

C A T I E

COMPARATIVE CONSOLIDATED INCOME AND EXPENDITURES

FOR THE PERIODS ENDING

DECEMBER 31, 1979, 1980, 1981, AND 1982

(US $000)

	1979	1980	1981	1982[1]
INCOME				
Basic Activity Budget	2,633	2,992	2,872	2,651
Special Funds (Covenants)	2,314	4,996	4,467	5,488
TOTAL INCOME	4,947	7,988	7,339	8,139
EXPENSES				
Basic Activity Budget	2,446	3,883	2,185	2,121
Special Funds (Covenants)	2,668	4,996	4,467	5,488
	5,114	8,879	6,652	7,609
Excess (Deficit) Income Over Expenses	(167)	(891)	687	530
Beginning of Year (Deficit) Surplus	59	(108)	(1,062)	(375)
Auditors' Adjustment	--	(63)	--	--
End of Year Surplus (Deficit)	(108)	(1,062)	(375)	155

1/ Unaudited figures.

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C A T I E

DETAILED INCOME AND EXPENDITURE STATEMENT

FOR THE PERIODS ENDING DECEMBER 31, 1979, 1980, 1981 AND 1982

(US $000)

	1979	1980	1981	1982[1]
INCOME				
Member Quotas	765	844	923	990
Services & Assets Administration	1,603	712	754	550
Covenants & Contracts Adm.	236	709	708	655
Special Funds for Covenants & Contr.	2,314	4,996	4,467	5,488
Currency Fluctuations	--	415	142	--
Donations	--	--	64	--
Other Income	29	312	281	456
	4,947	7,988	7,339	8,139
OTHER COSTS AND EAXPENSES				
General Direction	112	160	181	153
Technical Programs and Coordination	1,012	1,389	783	931
Support & Adm. Expenses	796	1,146	662	416
Substructure Expenses	--	--	--	132
Field Operations	460	433	241	179
Special Funds Programs	2,668	4,996	4,467	5,488
General Expenses	66	533	198	282
Financial Expenses	--	98	120	--
Asset Replacement	--	124	--	--
Currency Fluctuations	--	--	--	28
	5,114	8,879	6,652	7,609
Excess (Deficit) of Income Over Exp.	(167)	(891)	687	530

1/ Unaudited figures.

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C A T I E

STATEMENT OF ASSETS, LIABILITIES AND GENERAL WORKING FUND

AS OF DECEMBER 31, 1979, 1980, 1981 AND 1982

(US $000)

	1979	1980	1981	1982[1]
ASSETS				
Cash and Banks	193	379	799	432
Investments	--	--	135	503
Accounts Receivable	1,298[2]	401	463	500
Inventories	162	195	247	172
Prepaid Expenses	152	19	1	--
Special Funds (Covenants & Contracts)	--	694	272	238
Other Assets	327	--	--	--
TOTAL ASSETS	2,132	1,688	1,917	1,845
LIABILITIES AND GEN. WRKG. FUND				
Loans Payable	88	390	--	--
Accounts and Other Expenses Payable	967	1,149	849	127
Provisions	369	558	672	890
Special Funds (Covenants & Contracts)	816	653	771	673
	2,240	2,750	2,292	1,690
General Working Fund (Deficit)	(108)	(1,062)	(375)	155
TOTAL LIABILITIES AND GENERAL WORKING FUND	2,132	1,688	1,917	1,845

1/ Unaudited figures.

2/ Includes special funds.

EXPLANATION OF BUDGET ITEMS

I. Personnel

All project-funded personnel will be paid in accordance with the salary and benefits schedule which has been established by CATIE and is based on the United Nations System as adopted by IICA. The schedule in effect in February, 1984, was used in calculating all salary costs as well as benefits for international professionals such as family, education and housing allowances; insurance coverage; pension retirement fund; and post differential. Additionally, recruitment and repatriation, transportation of personal effects and installation benefits were calculated at the beginning and end of each international professional contract. A five percent annual gross salary increase was calculated throughout the project period.

A. International Professional Staff

The five senior professional staff positions will be filled by international professionals brought to CATIE from outside the region. The following assumptions were made:

1. The Project Manager must be employed beginning with the project initiation and will continue full-time for the five year duration. However, as an indication of CATIE's intention to make IPM a permanent, on-going endeavor, CATIE will absorb most of the costs associated with this position. This will be done by increasing CATIE's contribution beginning in year two and with the position being entirely financed by CATIE by the fifth year.

2. The remaining senior professionals will be employed as soon as possible after project initiation. For budgeting purposes some lag time has been built in to allow for recruitment and arrival of the specialists. In year four, CATIE will cover one-third of the cost of these positions with core funds or from other sources. In year five, CATIE will pay the full cost of the positions.

B. National Professional Staff

1. Country Coordinators

A coordinator will be located in each of the countries, and will be an experienced and senior technician. An approx-

imate figure of $30,000 for gross annual salary including all social and other benefits. It is a weighted average figure and assumes that 3-4 coordinators would be international professionals and 1-2 national professionals will be recruited in order to keep this cost item as low as possible.

2. Other National Professionals

The project will fund an administrative assistant as experience has shown that such an individual is needed to relieve the professional staff of routine duties such as accounting, purchasing and maintenance supervision. This individual will also be able to attend visiting scientists and other interested individuals in explaining and showing project activities. An annual salary of $12,000 has been budgeted initially for this position.

Project funded research assistants will follow a similar budgetary progression as that of the country coordinators. No funds are budgeted in the first year, however, as no in-country research is anticipated until year two. These assistants will be M.S. level professionals. An average annual salary of $16,000 has been budgeted for these positions.

C. Short-Term Consultants

A standard basic cost for a one-month consultancy was utilized:

Salary ($180/day x 20 days)	3,600
Per Diem $50/day average x 3o days	1,500
Travel (International & Regional)	1,200
Miscelaneous	700
TOTAL	7,000

These are average costs with the expectation that some will be higher and others lower depending on the contractual arrangements made when the services are provided.

D. Support Personnel

This category includes the personnel needed to permit the professional staff to maximize their time on project activities and produce all the materials expected to be developed by those activities. Normally, these costs are charged under overhead; however, they are specifically identified in this budget so that there is no confusion as to what services the project will require. When the

overhead was calculated, the cost of these personnel was substracted so that the project would not be charged twice.

The personnel in this category include (1) technicians who will assist the research staff with field work and other day to day activities which will enable the staff to expand their are of work; (2) secretaries; and (3) temporary staff to assist with a variety of short-term tasks such as field laborers, interviewers, special equipment operators, editorial and information publication specialists, and computer programming. All of these staff will be local national employees, and costs were calculated based on current CATIE figures for the expected types of professional and non-professional services.

II. Equipment and Materials

A. Computer/Data base/Information System Equipment

The equipment required for the project will be added to the existing computer center at CATIE and will be compatible with it.

	ITEM	COST
2	Expanded disc storage and real memory hardware	$ 50,000
3	Micro computers (PC) with 64 K memory, word processing capability, monitor screen, modern for hook up to mainframe, basic software for required programs and word processing.	22,500
1	Letter quality printer	2,500
1	Dot matrix printer	375
	Computer supplies	3,625
	TOTAL	$ 79,000

B. Laboratory Equipment and Supplies

12 Microscopes (2 at CATIE, 2 per country)	$ 15,000
6 Transfer chambers for sterile culture	3,300
8 Insect storage cabinets	9,600
6 Incubators	4,200
2 Refrigerators	3,000
1 Autoclave	3,000
5 Upright gas autoclave	2,500
Subtotal	$ 40,600
Supplies: Glassware, chemical reagents, vials, forceps, insect pins, head lenses, bunsen burners, thermometers, etc.	17,400
TOTAL	$ 58,000

C. Audio Visual Equipment

8 Audio visual viewers	6,000
5 Slide projectors	5,000
5 Overhead projectors	2,500
Cassette television for classroom use	4,000
Portable public address system	1,000
Cameras	9,000
Video Cassette recorder	1,500
Accessories	5,000
	$ 34,000

D. Pesticide Application and Safety Equipment

30 backpack sprayers	7,500
Protective clothing (gloves, boots, coveralls, masks)	1,500
Pesticides	4,500
Portable pesticide storage facility	2,000
	$ 15,500

E. Vehicles

Transportation is a limiting factor to success of field oriented projects in developing countries. A minimum of one vehicle, with 4-wheel drive capability for work on unimproved roads, are re-

quired in each country. Two similar vehicles will be maintained at CATIE for the project staff. Due to the short expected life of vehicles, the cost of two replacement vehicles is budgeted during the third year of the project. A per vehicle cost of $14,000 (delivered and tax exempt) was estimated.

F. Postage

The cost of sending a 5 ounce package from CATIE, Turrialba, Costa Rica to Guatemala City, Guatemala is $3.00. It is estimated that over 4000 items of project mail will be sent each year. This represents $12,000 per year. Although postage is expensive in the CA/P region, it is an essential item for information diffusion in the Technical Cooperation Component as well as essential to communication related to research and training activities. Postage costs will decrease from years 3-5 of the project as literature and newsletter information services become self sufficient.

G. Reference Materials, Supplies and Miscellaneous

Project personnel will require special reference materials such as books and professional journals to facilitate their work and remain current with developments in IPM in other parts of the world. Project funds will be used to purchase a basic set of books and the subscription cost of technical journals. Office equipment (to include a desk and chair, file cabinets, etc.) will be financed for each IPM specialist. A standard cost of $3,000 per office unit is assumed. The per unit cost also includes furniture and an electric typewriter for the secretaries.

III. Training

A. M.S. degrees at CATIE.

Current costs are approximately $8,000-$10,000 per year per student, depending upon origin (travel costs vary) and the variable costs of support for thesis research. The upper bound of the range ($10,000) was used to calculate costs. The M.S. degree program is two years in length.

B. Study Tours

Tours averaging two weeks in length are planned for in-service training of project staff. These will vary in cost depending upon where (within or outside region) in-

service training is arranged, and for how long. an average cost of $5,000 per study tour was used to calculate costs.

C. Workshops and Seminars

1. Initial training workshop for CATIE project staff.

a. CATIE-based participants do not require travel or per diem.

b. IPM coordinator's travel and per diem covered under Travel and Per Diem major line item.

c. Consultants
-1 consultant for 6 weeks.
-2 consultants for 3 weeks each
-1 consultant for 1 week.

Consultant fees: Average $900 per week x 13 consultant-weeks	$ 11,700
Per Diem: 7 days x $40/day/ person x 91 consultant-days	$ 3,400
International Travel: 4 persons at average $850.00 round-trip travel	$ 3,400
Insurance and miscellaneous	$ 1,200
	$ 19,700

d. Materials, supplies and closing session	$ 1,000
e. Local transportation and miscellaneous	$ 1,000
	$ 21,700

2. Seminars for Administrators

a. Travel for attendees: 10 persons at average regional travel cost of $375/person	$ 3,750

b.	Per diem for attendees: 10 persons, 2 days each, at $75/day	$ 1,500
c.	Materials and supplies	$ 200
d.	Meeting room rental	$ 200
e.	Local transportation and miscellenous	$ 100
	Per Session	$ 5,750
	X 2 sessions (one in year 2, one in year 4)	$ 11,500

3. Workshops for Researchers and University Teachers.

a.	Travel and local transportation for attendees: 15 persons x average in-country travel cost of $133/person	$ 1,995
b.	Per diem for attendees: 15 persons x 7 days each x $75 per day	$ 7,875
c.	Materials, supplies, closing session and miscellaneous	$ 525
	Per Session	$ 10,395
	X 10 sessions (two per country over life of project	$105,000

4. Workshops for Extension Personnel and High School teachers

a.	Travel and local transportation for attendees: 50 persons at avg. in-country travel cost of $133/person	$ 6,650
b.	Per diem for attendees: 50 personsx 5 days each x $75 per day	$ 18,750
c.	Materials, supplies, closing session and miscellaneous	$ 600
	Per session	$ 26,000
	X 10 sessions (2 per country over life of project)	$260,000

5. Seminars for Agribusiness personnel

-- No cost to project.

6. Seminars for Public Health Personnel

a.	Travel and local transportation for attendees: 10 persons x avg. in-country travel cost of $133/ person	$ 1,330
b.	Per diem for attendees: 10 persons, 2 days each at $75/day	$ 1,500
c.	Materials, supplies and miscellaneous	$ 570
	Per session	$ 3,400
	X 10 sessions (2 per country over life of project)	$ 34,000

7. Pesticide Management Workshop for Researchers and University Personnel (10) and CATIE and Project Staff (10)

a. Consultants (3):

Consultant fees: Average $900/week x 6 consultant weeks	$ 5,400
Per Diem: $40/day/person x 42 consultant-days	$ 1,680
International Travel: 3 persons at avg. $850.00/round-trip	$ 2,550
Insurance and Miscellaneous	$ 620
	$ 10,250

b.	Travel for attendees: 10 non-CATIE persons at avg. regional travel cost of of $375/person	$ 3,750
c.	Per diem for attendees: 10 non-CATIE persons x 14 days each x $40/day	$ 5,600

d.	Materials, supplies, local transportation, closing session and miscellaneous	$ 1,700
		$ 21,300

8. Pesticide Management Workshops for Extension, Administrators, etc.

a.	Travel and local transportation for attendees: 10 persons x avg. in-country travel cost of $133/person	$ 1,330
b.	Per diem for attendees: 10 persons x 3 days/person x $75/day	$ 2,250
c.	Materials, supplies, and miscellaneous	$ 420
	Per session	$ 4,000
	X 5 sessions (1 per country)	$ 20,000

9. Pest Management Economics Workshop

a.	Salary, International travel, per diem, insurance and miscellaneous expenses for two consultants	$ 4,700
b.	Per diem for attendees: 8 non-project staff persons x 3 days each x $75/day	$ 1,800
c.	Travel for attendees: 8 non-project staff persons x avg. regional travel cost of $375/trip	$ 3,000
d.	Materials, supplies, local transportation and miscellenous	$ 500
		$ 10,000

NOTES:
Per diem at CATIE = $40/day; elsewhere in region averages $75/day.

Travel and per diem costs for project staff participating (as trainees or trainers) in workshops are not included in these costs. They are included under "Travel and Per Diem."

IV. Construction

Project funds will finance the construction of a 1,500 ft^2 single floor pavilion type building to provide offices for project staff and research and diagnostic laboratories. The building will be a wing added to the existing office and laboratory space of the plant production department. The laboratories will be conditioned appropriately for research, insect collection, storage and diagnostic work. The construction will be similar to that of the tissue culture laboratory which was financed with ROCAP funds. Cost estimates were developed based on the cost of that building and include the necessary benches, gas connections, etc. needed to carry out lab work. The per square foot cost is $60 giving a total cost of $90,000.

V. Travel and Per Diem

The following assumptions were made in calculating travel and per diem costs:

a) To be successful, the project staff must travel continually to review status of activities in the countries, provide technical services and participate in training activities. Travel in the first year will be relatively low as initial efforts will be focused on working with the staff to prepare for the remainder of project activities. Beginning in year two, travel will increase considerably and will remain high over the final four years of project implementation.

b) Non-project funded staff in the plant protection department may provide advisory services and up to two trips per year within the region have been budgeted.

c) Country coordinators will be expected to visit CATIE [illegible] times per year to review project progress, for in service training, and coordination in general.

d) Country coordinators and research assistants will be expected to travel in country an average of 8-12 weeks per year to participate in research activities and provide advisory services.

c) The per diem averages used for calculations are based on existing averages. An average round trip air fare within the region was assumed to be $300, and costs for ground transportation was also included.

VI. Overhead

The overhead calculation was determined following the recommendation made by Price Waterhouse. That system resulted in a calculation of 30% to be charged to the estimated project costs. However, because the budget includes specific line items which normally are covered by overhead (e.g., administrative assistant, secretaries, etc.), those costs were substracted. When these costs are taken out the final overhead rate is 22.2% of all other budget line items.

ANNEX I-L

PROJECT IMPLEMENTATION PLAN

_____ indicates a continuing, major emphasis

o indicates a single event or an event which occurs at specific times

. . . . indicates an activity which occurs or may occur at times which cannot be specified at this point

ACTIVITY	'84	'85	'86	'87	'88	'89
A. Administration and coordination activities						
1. Sign initial project agreement CATIE/ROCAP	o					
2. Prepare key implementation letter CATIE/ROCAP	___					
3. Prepare first year's detailed work plan and budget for ROCAP approval	___					
4. Obtain first disbursement	___	o				
5. Search for, select, and recruit senior and support staff at CATIE and in-country		___				
6. Arrange for office/laboratories/work space/storage space for basic core staff		___				
7. Procurement of equipment for basic core staff		___				
8. Core staff on board (initially)		___	o			
9. Rapid review/modification first year operational plan and budget		o				
10. Preparation and finalization of additional letters of implementation		___	. . . . .			

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11. Search for, select, and recruit all additional project staff
12. Procure remaining supplies/ equipment
13. Establishment of agreements with participating national agencies
14. All additional staff on board

ACTIVITY	'84	'85	'86	'87	'88	'89
15. Annual work plans and budgets completed and sent to ROCAP for approval		—	—	—	—	—
16. Annual obligations of funds		—	—	—	—	—
17. Progress reports including executive summary		o o	o o	o	o	o
18. Annual technical reports		o	o	o	o	
19. Periodic financial/administrative reports		. . .	. . .	. . .	. . .	. . .
20. Annual financial/administrative reports		o	o	o	o	o
21. Final technical report						o
22. Final financial/administrative report						o
23. Project monitoring (ROCAP)	—	—	—	—	—	—
24. External evaluations		—				—
25. Short-term consultants		. . .	. . .	. . .	. . .	. . .
26. ROCAP-AID administrative technical assistance	. . .	. . .	. . .	. . .	. . .	. . .
27. CATIE-ROCAP evaluations			—		—	

B. Component 1: Research

1. Conduct workshop on crop loss assessment	—				—	
2. Design and conduct initial crop loss assessment study		—	—			
3. Select field sites for IPM research (sites added as resources permit over the life of the project)		—	— . . .	. . .	. . .	. . .
4. Diagnosis of pest management problems and design of tentative solutions		—	— . . .	. . .	. . .	. . .
5. Select and study individual farms for on-farm experiments			. . .	. . .	. . .	. . .
6. Experimental trial of tentative solutions			—	. . .	. . .	. . .
7. Validation of worthy experimental results				—	. . .	. . .
8. Development of recommendations for dissemination by national institutions				—	. . .	. . .
9. Publication of research results			—	—	—	—

ACTIVITY	'84	'85	'86	'87	'88	'89
10. Follow-up surveys of adoption of recommended technologies					———	
C. Component 2: Training						
1. IPM training of CATIE core staff	——	. . .	. . .	. . .	. . .	. . .
2. Training of pest diagnostic personnel	——	. . .	. . .	. . .	. . .	. . .
3. Preparation of training modules/ materials for broader seminar/ short courses/workshop/in-service training program		——	. . .	. . .	. . .	. . .
4. Disseminate training schedule		——	. . .	. . .	. . .	. . .
5. Identify and select participants for training		—	. . .	. . .	. . .	. . .
6. Arrange all logistic for training		—	. . .	. . .	. . .	. . .
7. Conduct seminars/workshops/short-courses/in-service training program (see Training Implementation schedule for details)		———	———	———	———	———
8. Develop training materials in IPM for high schools and post-high school non-degree institutions		———	———	———	———	
9. Announce availability of support for degree training	——	. . .	. . .	. . .	. . .	. . .
10. Prepare modules/material for degree training		——	. . .	. . .	. . .	. . .
11. Select candidates for degree training		—	. . .	. . .	. . .	. . .
12. First group starts graduate training		———	———			
13. Second group starts graduate training				———	———	
14. Select candidates for and initiate specialized non-degree training	. . .	. . .				
D. Component 3: Technical Assistance						
1. Diagnostic service announced and put into operation	——	. . .	. . .	. . .	. . .	. . .
2. Formation and development of pest reference collection	———	. . .	. . .	. . .	. . .	. . .

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ACTIVITY	'84	'85	'86	'87	'88	'89
3. Information Service Center						
a. Establishment of Center is announced in newsletter	———	. . . . .				
b. Information/documentation requests are serviced		———	———	———	———	———
c. Initiate planning for IPM newsletter	———	———	———	———	———	———
d. Newsletter published/ distributed	o	oooo	oooo	oooo	oooo	o
4. Technical assistance offered/ recruited	— —	. . . . .				
5. Instructional materials and training development assistance						
a. Necessary arrangements with national institutions are made	———	. . . . .				
b. Appropriate materials are designed		———	. . . . .			
c. Technical assistance in training development is made available		———	. . . . .			
d. Training modules, audio-visuals and similar materials are made available			———	———	———	———

ANNEX 1: A

PROJECT STAFF DESCRIPTION

This annex gives the qualifications and job duties of members of the Regional IPM Coordination Team and the Program Coordinators, described in IV-G of the project paper.

The Project Manager, IPM specialist, economist, and IPM Program Coordinators should each hold the Ph. D. degree and have extensive experience in their field of work. In addition, they should have considerable experience in LDCs, preferably Latin America. They should have a thorough understanding of and committment to IPM principles and procedures. Evidence of an ability to function effectively in an interdisciplinary group is essential. Teaching experience, especially at the graduate level and of the short-term training type is desirable. Fuency in Spanish, speaking and writing, is essential. The five IPM Program Coordinators should be Latin Americans, if possible.

Detailed descriptions of the qualifications needed for each position follow:

1. Project Manager

   A. Qualifications:

      Ph.D. degree in a pest related discipline (entomology, plant pathology, or weed science) and at least five years research experience in an IPM related interdisciplinary project in Latin America, teaching experience at the graduate level, and experience in the design and organization of short-term training. Administrative and project coordination experience for at least three years, preferably in Central America, is essential. Spanish fluency is essential.

   B. Duties:

      1. Has lead responsibility for planning and implementing the project activities with support from other members of the Regional IPM Coordination Team and IPM Program Coordinators, and coordinate them with CATIE's Crop Production Department, Renewable Natural

Resources Department, the Graduate Studies Program, and CATIE's other departments, ROCAP, and USAID Missions.

2. a. Direct project professional and technical staff.
   b. Direct project administrative and support staff.

3. Direct project activities.

4. Direct and coordinate the five IPM Program Coordinators.

5. Supervise the monitoring and reporting on project activities.

6. Advise graduate students.

7. Supervise and collaborate in the preparation of intructional material in IPM, including IPM training manuals, pest identification manuals, and teaching modules for both graduate courses and short-term training events.

8. Teach graduate courses related to IPM and serve as a principal resource in short-term training activities.

9. Direct, supervise, monitor, and report on all project research activities.

10. Supervise the technical cooperation activities of the project.

11. Account for project budget and funds.

2. Information Specialist

A. Qualifications

M.S. degree or equivalent in library science or information systems or proven competency in these fields. Must be experienced in or willing to become trained in use of computer data bases. Should have extensive library experience as well. Profeciency in editing and short-term training will be required. Spanish and English fuency required.

B. Duties

1. Responsible for all information management aspects of the project.

2. Work closely with CATIE's library and CIDIA (Centro Interamericano de Documentacion e Informacion en Agricultura) of IICA and become proficient in the use of the available computer bases.

3. Develop IPM data base/information system for project including:

   a. Bibliographic citations of relevant IPM literature in the CA/P region.

   b. Registration information on pesticides used in the CA/P region.

   c. Cataloging pest species and crops in the CA/P region.

   d. Cataloging of principal worldwide information sources relative to IPM.

4. Provide information search and referral service to the CA/P region.

5. Provide library photocopy services and library loans.

6. Publish and distribute a quarterly newsletter on IPM in the CA/P region.

7. Coordinate training and technical assistance in literature searching and documentation.

3. IPM Specialist 1 (Entomologist/Pesticide Coordinator)

A. Qualifications

Ph. D. in Entomology, with extensive knowledge of the principles and practices of IPM. Extensive experience in LDCs (preferably Latin America) in Entomology. Experience in teaching at graduate level and in short-term training. Spanish fluency essential. Experience in pesticide management principles and practices is also essential.

B. Duties

1. Responsible for all pesticide use, safety, and training.

2. Assist project manager in planning and teaching graduate courses and short-term training related to IPM and especially Entomology and pesticide management.

3. Advise two graduate students.

4. Supervise and collaborate in the preparation of instructional materials in IPM and Entomology, especially training manuals and teaching modules for both the short-term training and graduate courses.

5. Advise graduate students.

6. Participate in planning and execution of all research activities at CATIE and in the CA/P (with IPM Program Coordinators) related to Entomology and pesticide management in an IPM context.

7. Aid pest diagnostic services at CATIE and in the CA/P region with Entomological problems.

8. Assure that the project complies with AID's pesticide procedures.

9. Perform other functions as may be assigned by project manager.

4. IPM Specialist 2 (Plant Pathologist/Pest Diagnosis Coordinator)

A. Qualifications

Ph.D. in Plant Pathology, with extensive knowledge of the principles and practices of IPM. Extensive experience in LDCs (preferably Latin America) and in Plant Pathology. Experience in teaching at graduate level and in short-term training would be desirable. Fluency in Spanish is essential. Expertise in pest diagnostic services required.

B. Duties

1. Responsible for planning, coordinating, establishing, and strengthening pest diagnostic services of the

project at CATIE (with IPM Program Cooridnators) in each country in the CA/P region.

2. Assist project manager in planning and teaching graduate courses and short-term training related to IPM and especially Plant Pathology.

3. Advise two graduate students.

4. Supervise and collaborate in the preparation of instructional materials in IPM and Plant Pathology, especially training manuals and teaching modules for both graduate courses and short-term training.

5. Participate in the planning and execution of all research activities at CATIE and in the CA/P (with IPM Program Coordinators) related to Plant Pathology and pest diagnosis in an IPM context.

6. Aid Pesticide Coordinator at CATIE and in CA/P region in all pesticide management activities related to Plant Pathology.

7. Perform other functions as may be assigned by project manager.

5. IPM Specialist 3 (Weed Scientist/Agronomist-Training Coordinator)

A. Qualifications

Ph.D. in Weed Science and/or Agronomy with extensive knowledge of the principles and practices of IPM. Extensive experience in LDCs (preferably Latin America) in Weed Science and Agronomy. Extensive experience in teaching at graduate level and in short-term training would be desirable. Spanish fluency is essential.

B. Duties:

1. Responsible for planning and execution for all weed science research activities at CATIE and in the CA/P (with IPM Program Coordinators).

2. Coordinate all training activities sponsored by the project.

3. Assist in all graduate training and short-term training related to IPM and especially weed science/agronomy.

4. Advise two graduate students.

5. Coordinate, supervise, and collaborate in the preparation of instructional materials in IPM and weed science/agronomy, especially training manuals and teaching modules for both the short-term training and graduate courses.

6. Aid Pesticide Coordinator at CATIE and in the CA/P region in all pesticide management activities as they relate to weed science/agronomy.

7. Perform other functions as may be assigned by project manager.

6. Pest Management Economist

A. Qualifications

Ph.D. in agricultural economics, with knowledge of the principles and practices of IPM and experience in pest management economics. Experience in Latin America preferable and Spanish fluency essential. Experience in teaching at the graduate level and in short term training is desirable.

B. Duties

1. Responsible for all work related to pest management economics.

2. Assist project manager in planning and teaching graduate courses and short term training related to IPM and especially pest management economics.

3. Advise graduate students..

4. Participate in planning of all research and training activities at CATIE and in CA/P (with IPM Program Coordinators) related to pest management economics.

5. Consider socioeconomic constraints in the design of all project IPM research.

6. Analyze socioeconomic factors affecting transfer of IPM technology in the CA/P.

7. Perform other functions as assigned by the Project Manager.

7. Administrative Assistant

A. Qualifications

M.S. or equivalent in business management, accounting, or project administration. At least 2 years experience involving accounting, purchasing, and, preferably, maintenance supervision.

B. Duties

1. Responsible for all financial accounting related to the project.

2. Disburse funds according to CATIE/ROCAP procedures.

3. Prepare reports of all financial activities and disbursements of project.

4. Supervise purchasing of all supplies and equipment for the project.

5. Supervise maintenance of all major laboratory and field equipment plus all project vehicles.

6. Become thoroughly familiar with project activities in order to accommodate visiting scientists and others interested in the project.

7. Execute specific administrative tasks designated by the Project Manager in the absence of this latter individual.

8. IPM Program Coordinators (five positions)

A. Qualifications

Ph.D. in a pest related discipline (entomology, plant pathology, or weed science) and at least three years experience working in an IPM related field in Latin America - preferably Central America. The Coordinator must be

from Central America and preferably be a citizen of the country to which assigned. Experience in research and teaching in an IPM related field essential.

B. Duties

1. Plan, coordinate, and participate in project research and training activities in country to which assigned. Cordinate these actities with appropriate national or regional entities.

2. Direct project technical staff in country to which assigned.

3. Collaborate in the preparation of institutional materials on IPM, especially relative to assignead country.

4. Monitor and report on all project activities in assigned country.

5. Cooperate with the technical cooperation activities of the project, especially pest diagnostic services.

6. Advise graduate students.

7. Maintain linkages with all national institutions with crop protection or IPM activities in country to which assigned.

8. Aid the project Pesticide Coordinator in all pesticide management activities in assigned country.

9. Perform other functions as may be assigned by Project Manager.

ANNEX II-B

GUIDELINES FOR THE DEVELOPMENT AND APPLICATION OF INTEGRATED PEST MANAGEMENT

Integrated pest management provides a long-term strategy for minimizing losses caused by pests with least possible cost ot the farmer or disruption of the environment. IPM treats pests as a component of the total system of crop production, which includes not only crops and pests, but also the physical, biological, and socioeconomic environments in which the pest problems occur. The goal of an IPM program is to coordinate crop protection activities with all production practices to achieve economical and long-lasting solutions. In IPM, the emphasis is on anticipating and preventing pest problems, whenever possible, and applying needed corrective measures systematically on the basis of sound economic rationale.

Each farming situation requires a somewhat different set of production and pest management inputs for greatest profitability, and the requirements may change from year to year. Climate, soil type, cropping and pest history, cultural practices, cultivar, and the nature of the surrounding environment all affect pest problems on a given site and, consequently, the requirements of the IPM strategy.

Development of a specific IPM program must therefore be based on an understanding of several factors:

-Kinds of pests infesting the crop and their potential effect on yields at different levels of abundance

-Relationship of plant development (plant phenology) and the crop's susceptibility to the pests

-Anticipated crop yield and economic potential

-Natural forces (e.g., natural enemies, weather) operating against the pests

-Availability and cost of control methods, both chemical and nonchemical

-Socioecomic characteristics of the production unit

-Impact of the control methods on human health and environment.

Once these factors are reasonably well understood, an IPM program can be developed and tested on farmers' fields. Because the IPM program must be tailored for the particular intended beneficiaries, it is difficult to establish absolute guidelines. However, the following guidelines generally apply in developing IPM programs, regardless of the kinds of crops, pests, and farming systems involved:

Step 1: Conduct Crop Loss Assessments and Determine when Control of the Pests Becomes Profitable

Pest organisms may be classified into five main groups:

-Insects and mites

-Plant disease agents, including fungi, bacteria, viruses, and nematodes (roundworms)

-Weeds

-Vertebrates, such as rats and birds

-Snails and slugs

Any one group may contain several potentially harmful pest species. A given crop field occasionally may be infested with many species of all groups. For each situation, however, there are rarely more than a few pest species which will cause economic losses if not controlled.

The occurrence and development of pests usually is closely related to a particular stage of crop growth and to various environmental conditions. However, the severity of pest problems usually cannot be accurately predicted in advance. Therefore, fields must be inspected regularly to determine if pests actually are causing damage and how much damage can be tolerated.

The population level that determines whether a potentially harmful species has attained "real" pest status is called the "economic threshold". The economic threshold may be expressed in different ways, depending on the crop and the pests, for example:

-Number of insect larvae per plant

-Percentage of fruit damaged by a given pest

-Numbers of weeds per square meter, etc.

The economic threshold is the "break even point" in crop protection. When a pest population remains below the economic threshold level, the cost of applying control measures exceeds the losses caused by the pest. Above this level, control becomes profitable.

The economic threshold for a given pest depends on crop variety and its stage of development, potential value of production, fertilizer use, presence of natural enemies that attack the pest, whether the crop harvest is to be exported or consumed locally, cost of control measures, and other variables determining the magnitude and value of expected losses and control efficacy.

The economic threshold recommended to farmers must be based on research and field trials. However, experienced research scientists and extension agents, familiar with the characteristics of crop development and pest dynamics, often can establish preliminary, crude threshold levels. These can be tested on a few farmers' fields and refined as more information becomes available. By inspecting the fields regularly and applying pesticides according to economic threshold levels, pesticide use on a given crop often can be reduced significantly without sacrifice of crop field or quality.

Step 2: Determine What Control Methods are Available

Many methods have been developed for controlling pests. Some of the most effective methods, such as pest-resistant crop varieties, crop rotation and other cultural practices, and biological control, have been known and used for many years and are well suited for use in IPM programs. Recently, however, there has been a tendency to overlook these methods and to rely heavily on pesticides instead. Experience has shown that crop yield increases and yield stability are more likely if crop protection is based on a combination of control methods. The most long-lasting crop protection programs draw from all available methods known to be safe and effective in keeping the pests below economic threshold levels. Following are the most important methods:

Resistant Crop Varieties

Some crop varieties are genetically resistant to certain pests. Plant breeders have used this natural process to their advantage by deliberate selection of agronomically acceptable varieties resistant to pest attack. Use of resistant crop varieties is a proven, ef-

fective, economical, and safe method of avoiding damage from many insect pests and disease organisms.

Biological Control

Biological control, i.e., the use of natural enemies such as parasites and predators for the reduction of pest populations, is most commonly used with insect, mite, and certain weed pests. Biological control agents may occur naturally in the confines of a crop; they also may be established by deliberate introduction into the crop environment. Unless the biological control agents are disturbed by chemical pesticides or other disruptions, they naturally help reduce the level of pest incidence. However, many crop pests in Central America originated from other countries, and thus lack the biological control agents which occurred naturally in their countries of origin. Bringing in natural enemies from a pest's original home often is a highly effective tactic for establishing biological control of imported pests.

Cultural Control

Cultural control is the deliberate manipulation of the crop environment to make it less favorable for pests. This is one of the oldest and most effective methods of pest control. Cultural control methods are especially suited for use by Central American small farmers who are already familiar with many traditional cultural practices. The following are just a few examples.

-Rotating a crop of one plant family with a crop of another plant family that is not a host crop of the target pest

-Destroying alternate plant hosts (weeds, volunteer crop plants, etc.) of insect pests and diseases

-Regulating planting time so as to avoid certain crop pests

-Harvesting the crop early to avoid the buildup and carry-over of pests into the next crop

-Using good quality certified seed and pest-free planting stock

-Managing soil fertility and caring properly for the crop plants

-Increasing crop diversity using crop mistures as opposed to pure stands --this sometimes will increase beneficial natural enemies in a given crop or attract insect pests away from susceptible crops to nonsusceptible crops.

Mechanical-physical Control

This method includes those physical measures which destroy the pests outright or make the environment unsuitable for their entry, dispersal, survival, or reproduction. Like cultural controls, mechanical-physical controls exploit weak links in the pest's life cycle or specific behavioral patterns. Examples are:

-Traps for rats, mice, and birds

-Metal barriers around the trunks of coconut trees to prevent rats from crawling up to the coconuts

-Fire

-Hand picking weeds and insects

-Hand weeding or mechanical cultivation

-Pruning disease infested plant parts.

Pesticides

Pesticides are chemicals used to destroy, repel, or otherwise control pests. The main types of pesticides and their use are:

-Insecticides: control insects

-Acaricides: control mites

-Nematicides: control nematodes

-Bactericides: control bacteria

-Fungicides: control fungi

-Herbicides: control weeds (undesirable vegetation)

-Rodenticides: control rodents such as rats.

These chemicals are often essential in IPM programs and their proper management can enhance the overall effectiveness of the IPM effort. However, in IPM, they are integrated into the farming operation only after it has been determined that their use will lead to a positive net result. Procedures for integrating pesticides into IPM programs are discussed in Step 3.

Step 3: Select and Integrate the Control Methods on the Basis of Economic and Environmental Consequences

Choosing the best combination of control methods for a given crop will depend on several factors:

-Pest complex

-Value of the crop

-Whether the crop is being grown for local consumption or export

-Farmer's income, credit availability, and cash flow requirements

-Cost of control methods

-Labor requirements

-Impact of the methods on human health and the environment

The most important principles in making a choice of pest management methods are:

-Use a pest control method only when there is evidence that its benefits outweigh its costs

-Do everything possible to prevent the pests from reaching economic threshold levels by using nonchemical methods such as:

-resistant crop varieties

-biological control

-cultural control

-mechanical-physical control

-Apply pesticides only when the pests reach or exceed economic threshold levels

-Seek pesticides that cause the least herm to:

-humans

-livestock

-natural environment

-honey bees and other important pollinators

-biological control agents in the crop fields.

In IPM programs, careful selection of pesticide dosage and time and method of treatment reduces problems associated with the use of pesticides. The pesticides used should be as selective as possible, operating primarily against the target pests and causing minimal harm to the beneficial species (e.g., natural enemies, honey bees, and other pollinators) and other non-target elements. Pesticide formulations can be chosen and application techniques used so as to achieve this selectivity. For example, granular formulations generally are more selective than liquid (spray) formulations. Application techniques that direct the pesticides to specific parts of plants that harbor pests (base of the plants, top foliage, etc.), avoid periods of natural enemy activity, or lower the dosage level may enhance selectivity and also lower costs of control. Planting a small stand of a "trap crop" that attracts mobile pests to a highly concentrated area reduces the area over which pesticides need to be applied.

Step 4: Use the Control Methods Correctly and Safely and Assess the Situation Carefully Before Applying Them

Pesticides can create many serious problems if not used properly, as pointed out in other sections of this project paper. However, improper use of alternative non-chemical methods can have similar consequences. Each pest control method has certain advantages and disadvantages, and the relative merits of each should be weighed in advance and monitored during implementation.

Knowing when not to use a control method is as important as knowing when to use one. By carefully assessing the pest situation, it may be possible to delay --or avoid altogether-- the application of a pesticide or to apply an effective alternative method that is less expensive.

Step 5: Comply with all Legal Controls that Apply to the Situation.

Legal controls result from laws and regulations and include:

-Quarantines to prevent the entry and establishment of foreign plant and animal pests into a country

-Local laws and regulations that govern pesticides

-Pesticide restrictions and regulations in projects financed by outside donors.

Step 6: Develop Procedures for Transfering the IPM Program to the Intended Farmer Beneficiaries

The ultimate test of IPM is whether or not the farmers use it. New IPM technology offers no real utility to anyone unless it is adopted successfully by these individuals. Experience in many parts of the world, both developed and developing, has shown that farmers will adopt IPM technology if they see advantages for adopting it and if they can understand and utilize the technology with relative ease. Its successful adoption is therefore heavily dependent on education and a continuing input by extension personnel. The extension services must develop simple educational materials and carry out IPM demonstrations so that the farmers may see their advantages and learn how to implement IPM programs in their respective cropping situations.

ANNEX II-C

LIST OF PERSONS CONTACTED BY PROJECT DESIGN TEAM AND ITINERARY

A. CONTACTS

1. Contacts in CATIE - Turrialba, Costa Rica

Ana Maria Arias	Onton Memorial Library
Alberto Beale	Weed Scientist
Helga Blanco	Documentalist
Gerardo Budowski	Ecologist
Carlos Burgos	Head, Dept. of Plant Production
German Escobar	Economist
Jose Galindo	Plant Pathologist
Mario Gutierrez	INFORAT, Agricultural Forestry
Richard Hawkins	Agronomist
Donald Hazlett	Ecologist
Julio Henao	Data Processing
Humberto Jimenez	Documentalist
Donald Kass	Soil Scientist
Craig Mc Farland	Natural Resources
Claudia Monge	INFORAT, Agricultural Forestry
Raul Moreno	Plant Pathologist/Agronomist
Luis Navarro	Economist
John Palmer	Agricultural Forestry
Raul Picon	Planner
Carlos Quezada	Watershed Management
Marciano Rodriguez	Agronomist
Herman Rodriguez	Administrative Assistant
Joseph Saunders	Entomologist
Tomas Schlichter	Ecologist
Margaret Smith	Plant Breeder
Rodrigo Tarte	Director General

2. Other Contacts in Costa Rica

Juan Coward	Agricultural Project Manager
Finn H. Damtoft	Director, CIDIA - IICA
Federico Dao	Director, Programa de Sanidad Vegetal, IICA
Guillermo Galvez E.	Bean Program Coordinator for Central America - CIAT/IICA

David Gardella	Rural Development Office, AID
Luis Carlos Gonzalez	Dean, Faculty of Agronomy, University of Costa Rica and 13 of his staff members (including weed science, plant pathology, encomology, plant physiology, economics & plant breeding).
David Joslyn	RADO, AID/ROCAP
Quentin West	Sub-Director, IICA
Aart van Schoonhoven	Director, Bean Program 1- CIAT

3. Panama

Alfredo Bernal	Dean Facultad de Agronomia Universidad de Panama
Carlos Campos	Director, Laboratory of Ministry of Agriculture Plant Sanitation Division
Chavarria	IDIAP Regional Director, David
Cordero	Entomologist, Faculty of Agronomy, David
Donald Drga	Project Officer, AID
Ezequiel Espinosa	Director, IDIAP
Mario Garristo	MIDA - Sanidad Vegetal, David
Mark Gaskell	Rutgers/Cornell AID, Project - Volcan
Luz Graciela Joly	Faculty of Agronomy, David
Juan Osorio	Nematologist, Faculty of Agronomy, David
Alberto Perdomo	IDIAP
Gene O. Ott	University of New Mexico/Facultad de Agronomia, Universidad de Panama, David.
Jorge Pinochet	IDIAP (AID Contract)
Roberto Rodriguez	IDIAP and Coordinator PRECODEPA, Cerro Punta
Gale Rozelle	Chief Agriculture Division, AID
Phillip Shannon	ODA/CATIE - Entomology
Rodrigo Tarte	IDIAP
Jaime Roman	Rural Development Office, AI

4. HONDURAS

Mario Contreras	Contractor, AID
Gordon Straub	Deputy RDO, AID

EAP - ZAMORANO

Keith Andrews	Entomologist, IPM Project Manager
Rafael Caballero	Entomologist
Jorge Chang	Economist
Rafael Diaz	Agronomist
John Dick	Entomologist (Peace Corps)
Simon Malo	Director
Carlos Perez	Plant Pathologist
Jorge Roman	Dean

SIATSA, LA LIMA

Russ Caid	Assistant Vice-President, Research
Chris Millensted	
Gene Ostomack	Entomologist
Pablo Soto	Entomologist
Harry Stover	Plant Pathologis

5. EL SALVADOR

Jose W. Aguilar	Division Investigacion, CENTA
Mario Aponte	IPM Project, Cotton, AID
Santos Pastora	Cotton IPM Project, CENTA
Ovidio Bruno	Division Investigacion, CENTA
Mauricio A. Coreas	Cotton IPM Project, CENTA
Miguel Granillo	Head, National Planning Office, Agricultural Section
Luis Guerrero	Basic Grain Program, CENTA
Mauricio Guzman	CENTA
Emidlia Guzman	Chief, Department of Laboratory Services, CENTA
Tom King	Acting Rural Development Officer, AID
Jose E. Mancia	CENTA
Debbie Maxwell	IPM Project, Cotton, AID
Manuel Ponce	Director, CENTA
Arnoldo Trejo	Horticulture, CENTA
Jose H. Soriano	Director, Defensa Agropecuaria

6. GUATEMALA

Victor Hugo Benitez	Sanidad Vegetal, MAG
Manuel Cano	Sanidad Vegetal, MAG
Angel A. Chiri	Regional Pest Management Specialist, ROCAP.

John R. Eyre	Acting Director, ROCAP
Astolfo Fumagalli	ICTA, MAG
Kevin Kelly	Project Development Officer, ROCAP
George Like	Economist Assistant,USAID
Fernando Mazariegos	ICAITI
Eduardo Villagran	Contractor, USAID
Frank Zadroga	Regional Environmental Management Specialist, ROCAP
Julian Herriot	Economist, ROCAP
Barton Goldenberg	PSFO, AID/W

B. ITINERARY

1. Guatemala

DATE	TEAM MEMBERS/LOCATION (D. Bottrell, K. Reichelderfer, J. Saunders, D. Thurston, V. Freed, A. Niles)
01/23/84 01/26/84	ICTA, ICAITI, DIGESA, and ROCAP (D. Bottrell, J. Saunders, A. Chiri))
02/24/84	ROCAP and ICAITI (V. Freed)
03/03/84	ROCAP (A. Niles)
03/05/84	ROCAP (A. Niles)
03/06/84 AM	to Guatemala City
PM	ROCAP
03/07/84	ROCAP
03/08/84	ROCAP
03/09/84	ROCAP
03/10/84	ROCAP (Reichelderfer & Thurston to USA)
03/11/84	
03/12/84	

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03/13/84	
03/14/84	Bottrell and Saunders depart Guatemala

2. Costa Rica

DATE	TEAM MEMBERS/LOCATION (H. D. Thurston, F. Fliegel, J. Saunders, K. Reichelderfer)
02/06/84	University of Costa Rica (D. Bottrell, J. Saunders)
02/17/84	University of Costa Rica, Faculty of Agronomy, San Jose
02/27/84	IICA, Sub-Director, San Jose CIDIA, IICA, San Jose CIAT/IICA Bean Program Coordinator Peace Corps (Telephone)
03/06/84	To Guatemala

*All remaining time of the Project Design Team was spent at CATIE, Turrialba, Costa Rica.

3. Panama

DATE	TEAM MEMBERS/LOCATION (H. D. Thurston, R. Moreno, David Joslyn)
02/20/84	To Panama
02/21/84 AM	USAID Mission, Panama Ministry of AGriculture, Plant Sanitation Division University of Panama, Faculty of Agronomy
PM	To David, Chiriqui

02/22/84 AM	IDIAP Regional Director Ministry of Agriculture, Sanitation Lab. To Caison & VOlcan, met Mark Gaskell To Cerro Punta, PROCEDEPA & MAG Potato labs
PM	Return to David
02/23/84 AM	University of Panama, Faculty of Agriculture, David
AM & PM	Return to David
02/24/84	Return to Costa Rica

4. Honduras

DATE	TEAM MEMBERS/LOCATION (D. Bottrell, H. Coble, A. Chiri, K. Reichelderfer, J. Saunders, B. Waite)
02/09/84 AM	USAID and EAP
PM	EAP, Zamorano
02/10/84 AM	To SIATSA
PM	To Costa Rica

5. El Salvador

DATE	TEAM MEMBERS/LOCATION (D. Bottrell, H. Coble, K. Reichelderfer, A. Chiri, J. Saunders B. Waite)
02/07/84 AM	To El Salvador
PM	AID Oficina de Planificacion, Sectorial Agricola, CENTA
02/08/84 AM	CENTA
PM	To Honduras