REGIONAL COFFEE PEST CONTROL PROJECT

ROCAP PROJECT NO. 596-0090

EXTERNAL FINAL PROJECT EVALUATION

An evaluation of the ROCAP/AID-IICA grant funded project, initiated in 1982, in support of research, packaging of production recommendations and small farmer transfer on the control of coffee rust (Hemileia vastatrix, Broca (Hypothemus hampei) and use of new rust resistant varietal selections in Central America and Panama under PROMECAFE.

San Jose, COSTA RICA

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EXECUTIVE SUMMARY

A final project evaluation has been completed on the Regional Coffee Pest Control Project (ROCAP Project Number 596-0090) in accordance with the Project Agreement signed by the Interamerican Institute for Cooperation in Agriculture and A.I.D./ROCAP. The project initiated operations in January 1982, under PROMECAFE, created in 1979, as a regional collaborative initiative of the five Central American nations, Mexico, Panama and the Dominican Republic, to coordinate research and information transfer regionwide. The major focus of this initiative was to combat the threat of coffee rust, coffee berry borer and similar pests of this primary source of foreign exchange, employment and rural sector income. Coffee generates over 2.5 million jobs annually, provides over US$1.3 billion in foreign exchange and is grown on over 250 thousand small farms throughout the region.

The project has been managed by IICA with applied research and training at CATIE and in the member countries. It has supplied technical assistance, facilities and equipment for national and regional research on varietal improvement, rust and coffee berry control, more efficient transfer of new technology to small producers, pesticide residue analysis and the development of a regional information network. It has also trained national researchers, extension personnel and laboratory technicians on modern coffee culture, plant genetics, pest management, communications, and data/information methods through seminars, workshops and regional program coordination meetings.

The project has in general been well managed, used its resources well and has attained or surpassed most of the goals planned at the outset of the project grant.

Training, research coordination and information transfer experience, gained through this project, have greatly benefitted all of the national coffee programs and created a level of technical competence and confidence at the national level not seen in other regional initiatives.

The project has resulted in an expansion of the number of national researchers and information transfer agents now working in coffee. Some 99 new regional plant improvement trials, containing over 300 new rust resistant and other coffee selections were planted in member countries. Rust and coffee berry borer research have established the life cycle of these pests and improved recommendations are now being provided to small producers.

The information transfer work has greatly improved the efficiency of dissemination of new information and its adoption by over 20.000 small beneficiaries regionwide. New knowledge is accumulating on the importance of pesticide residues. The refocus of the coffee variety selection methodology used before the project and the development of a new asexual plant reproduction system, now promises a major new breathrough in coffee plant improvement.

In addition, the PROMECAFE project has also attracted technical assistance and training support and plant materials from the IRCC of France, the CIFC in Portugal, the Federal University of Vicosa in Brazil, CENICAFE in Colombia and others. In the view of the evaluation team, this level of cooperation and outside technical assistance and the resulting progress of the project, could not have been accomplished on a country by country basis.

Some of the major accomplishments of the project to date include:

1. More than 4,549 participants have attended over 146 national and regional courses, workshops and coordination meetings.

2. A new method of reproducing coffee using microcuttings has been developed and is now ready for testing at the commercial level. It can reduce by almost thirty years, the time required between selection of a superior rust resistant plant and its release as a commercial variety.

3. Rust control research has shown that only one to three sprays of a copper based fungicide, applied at the proper time, will give excellent control of rust instead of five to eight sprays recommended in 1981. The amount of chemical required per application can also be reduced by thirty percent. This can reduce small farmer costs for rust control by at an estimated US$36 - US$45/ha. annually.

4. Research on coffee berry borer (broca) control has shown that the damage from this insect varies from year to year and area to area. When the infestation is low, the removal of fallen fruit and late maturing fruit alone on small farms, can reduce the infestation the next year to below ten percent. In high infestation years, the application rate of "endosulfán" can be reduced from six applications recommended in 1981 to one to three applications if properly timed.

5. Although the programmed development of two to three new rust resistant varieties of coffee will not be attained at the end of this project (an unrealistic project goal to start with), the work in progress promises to develop a number of rust resistant lines in the next three years, having a yield potential well above present susceptible commercial varieties. None existed at the outset of this program.

6. The combination of the use of microcuttings and plants identified as outstanding resistant types being selected in the countries in the next several years, can bring the region's plant improvement program to the forefront of world coffee development. If the information in the PIADIC Data Bank can be brought up to date and used to identify analogous ecological areas regionwide for these few selections, enormous changes are possible in the coffee industries of the member countries in the next decade.

7. The use of Farming Systems approach to generate appropriate technology, combined with the extension technique of farmer groups (Grupos de Amistad y Trabajo), proved quite successful in raising production levels of small farmers.

8. The project provided a genuine networking vehicle for technician and information exchange between countries and international centers of excellence. This mechanism was very beneficial in terms of institutional development in the region.

EVALUATION CONCLUSIONS AND RECOMMENDATIONS

The Coffee Pest Control Project has had a remarkable positive effect on national research and information transfer programs regionwide. It has also solidified the coordination efforts, at all levels, among the participating countries It has, as a result, strong support of national coffee institutions and the Ministries of Agriculture.

This Project's extensive training program surpasses project goals and has, through training courses and publications, had a remarkable effect on the technical understanding of modern coffee production, research methods, cultural practices, rust and coffee berry borer epidemiology, control and laboratory procedures throughout the region. The program also has made major changes in the philosophy and effectiveness in the packaging, transfer and adoption of new production methods for pest control and coffee culture on thousands of small farms.

The project has had good overall leadership and has managed its personnel and expenditures within the budget. The program coordinating council has met regularly and made sound decisions on new areas of research and transfer within the scope of the project. It has also promoted greatly improved coordination of efforts, exchange of plant materials and research results, regionwide.

The project has attracted the support of other technical assistance institutions. The IRCC has placed three highly qualified coffee specialists in the area that work as an integral part of the overall effort. Likewise, the CIFC (Portugal), the Federal University of Vicosa (Brazil) and CENICAFE (Colombia) provide plant material and test new crosses of coffee made in Central America for various races of rust. The cooperation of ICAITI in residue testing and CATIE in a range of project activities is noteworthy. A number of private companies have also provided chemicals and analytical

procedures to this regional effort. This collaboration would not have been possible on a bilateral basis.

The project has as yet not attained all of the goals set forth in the project agreement. It is, at this time too early to select new superior lines of rust resistant varieties. Work in this area is well advanced and progressing exceedingly well. However, three additional years will be required to begin to see the full potential of this program element. Coffee rust and coffee berry borer (CBB) research has proven that significantly reduced levels of chemical applications and improved plantation sanitation can control these pests at economically feasible costs on small and large farms.

The fact that only one CBB control chemical has been found to date, points out the need for further research in this area and the timing and cost of pest control on low, medium and high producing farms warrants additional study.

The residue program is, as yet, at an early stage and remains inconclusive. It has shown that coffee beans have relatively high levels of selected insecticides and heavy metals applied to the trees for pest control, which must be further researched to determine the exact source of these compounds and ways that they can be reduced to tolerable levels.

The information packaging and transfer program has greatly increased the ability of transfer agents to reach larger numbers of producers effectively and efficiently. It has not yet developed procedures and strategies that will permit all coffee farmers to fully benefit from the program in the next five to ten years.

The microcutting method developed, offers a major breakthrough for the entire plant improvement program and appears to permit moving from selected plants to commercial varieties without thirty to fourty years of backcrossing to standardize a variety. However, it has not been tested on a commercial scale as yet.

The success of the program to date, raises additional problems and potentials. Further progress is needed in solidifying the research and transfer procedures among countries. Additional training is needed in research and transfer program management. Further improvement is essential in controlling nutrient deficiencies in the field, in order to gain full yield potential from new varieties, pest control and cultural practices. More serious efforts are needed by ROCAP, PROMECAFE and the member countries to secure producer credit so that the new techniques can be utilized more rapidly and effectively by larger numbers of small producers.

The work done to date has begun to only set the stage for the real changes foreseen for the coffee industry of the region. Its progress has been outstanding. Its potential even greater. PROMECAFE and AID/ROCAP have received full value for their contributions to date. However, a three to four year extension of this project is proposed in the strongest terms, by this team, in order to solidify the system and allow the progress made into efficient farm level outputs for the region's 250,000 small producers.

The continuation phase of this project should solidify past experience and focus sharply on the following:

1. Project Management

   a. IICA should continue as the management agent of the project throughout the proposed extension.

   b. No change should be made in the location of this project in IICA's new organizational structure from the Central Area Office, where it has functioned very well, to Line II Development and Transfer of Technology.

c. The leadership of Dr. Carlos E. Fernández has been crucial to the program and should be continued for the three year proposed extension of the program to continue the extremely effective leadership he has provided the entire program.

d. Increased country financial support for PROMECAFE is needed and country contributions should be brought up to date (especially that of Costa Rica and El Salvador).

e. Bilateral USAID assistance should not be limited to credit or extension activities, but must include assistance to national research efforts as well.

f. Other international agencies and the private commercial sectors should be stimulated to increase their linkage to, and financial support for PROMECAFE.

2. Development and Reproduction of Rust Resistant Varieties

a. This program should be continued at all cost. It should continue to collect data on existing selections and when four years of information are available, plant the most outstanding new rust resistant high yielding lines/clones in verification trials, using microcuttings, in analogous ecological situations on a large scale.

b. A procedure must be developed to reduce the number of plants/clones on which data is collected at the earliest possible date. New crosses are constantly being evolved and should be tested in the countries, without overloading the data collection capacity of national programs.

c. Data is now hand tabulated at the country level. With the new computerized recording system developed at CATIE, all national

programs should be provided with a computer and all data recorded in this system. Duplicates of all data must be sent by floppy disks to CATIE for maintenance in the central data bank.

d. The PROMECAFE central data bank should use the data collected, to determine the most promising lines to be used in future crosses and guide pest control studies regionwide.

e. The IRCC should be strongly encouraged to maintain their technician Dr. Marc Berthouly at CATIE, to continue the microcutting and other tissue culture research with the PROMECAFE team.

f. The microcutting system should be installed in El Salvador, Honduras and Costa Rica (if past debts are paid to PROMECAFE) on a commercial scale and national technicians trained. Its first use, in these countries, should be to multiply the best new rust resistant selection for on farm testing in different ecological situations. When proven cost effective, private individuals should be trained in the process to produce large numbers of clonal plants for commercial plantations both small and large.

3. Rust Epidemiology and Control

a. A rust pathologist must be employed to replace Dr. Zia Javed. This person should continue to provide leadership and technical coordination in epidemiology and control of the disease in El Salvador as well as expand assistance to other country programs.

b. Improve the methods of fungicide application and the evaluation of spray equipment.

c. Train pathologists at the M.Sc. level, in countries where rust research programs are in progress.

d. Improve the linkage and use of coffee rust research results, through information transfer, so they may be put into practice on small farms as soon as possible.

4. Coffee berry borer control

a. The IRCC should be requested by PROMECAFE and ROCAP to retain the services of Dr. Bernard Decazy for at least one more year and overlap him with another senior IRCC entomologist to continue the CBB research program.

b. Expanded screening is needed, of other insecticides, to find alternatives to "Endosulfán."

c. A sampling method, at the farm level, must be developed to guide producers on when to apply chemical CBB control.

d. Rapid survey methods for coffee berry borer are needed on a national basis to determine where and when control measures should be promoted by the extension service.

5. Residue Analysis and Control/Registration of Pesticides

a. Further applied research and analysis of samples of green coffee bean and the beverage are urgently needed, to pinpoint the source of lead found in samples to date and reduce it as quickly as possible.

b. Fungicide manufacturers must be encouraged to change their formulations of agricultural chemicals to reduce the level of heavy metal contaminants in their products, especially lead. Their

application recommendations must also be changed to reduce bean and beverage contamination.

c. National governments must develop uniform registry and analysis of agricultural chemicals used in coffee. OIRSA should be requested to assist in this effort or some other organization (ICAITI) must assume this important function.

d. Technicians working in the field and laboratory should be trained in the hazards and management of agricultural chemicals used in coffee. Practical chemical use procedures must also be included in farmer training programs as soon as possible.

6. Training of Technical Personnel

a. Expanded training of national technicians in research and extension management is urgently needed, as is the control of nutrient deficiencies. The results of this training must be used in all research and demonstration experiments and the design of new programs.

b. Training on multimedia presentation are needed to reach larger numbers of small farmers at lower cost to complement the "Grupos de Amistad y Trabajo".

c. More farmer publications are needed on: (1) Modern production methods; (2) Integrated Pest Control; and (3) Rust resistant Varieties.

d. Training is badly needed on the economics of improved production practices and transfer methods.

e. Regional technicians should be sent to Europe (especially England) for training in the use and testing of spray equipment.

7. Development, Adaptation and Transfer of new Technology

a. Greater emphasis on the economics of production and alternate transfer/use methods are badly needed.

b. Develop a computerized system to extrapolate site specific research findings to analogous areas regionwide. The PIADIC data in this area will be an invaluable source.

c. Further in-depth study is needed on the value of para-technicians as multiplier agents for extension outreach.

d. Continued use of a systems approach for technology development and transfer as a linkage mechanism between the extension agent and the farmer is strongly recommended.

8. Data Bank

a. The IICA regional data bank must be made fully operational at CATIE.

b. IICA should be made to respond to its commitment, under the project, to provide personnel to manage and operate this bank.

c. Countries must provide copies of all research data on varieties, rust and CBB research, other biological studies, economic data and information transfer results to the Central Bank. This information should be analyzed regionally and results transferred back to national programs. The confidentiality of unpublished national data/information must be assured at all times.

9. Coffee Literature

a. Countries should have access to the bibliography in coffee being developed by IICA librarians, at CATIE.

b. Technicians must prepare full literature reviews, before beginning any new studies on particular research problems.

c. Research and/or extension agents should prepare results of their work on a timely basis and publish it in the CATIE publication "Turrialba," a PROMECAFE publication, and similar national publications.

d. Because of the extremely poor libraries in national coffee institutions, the CIDIA/CATIE librarians and project technicians should develop a list of basic coffee and agricultural publications that should exist in each national insitution, plus specialized subject matter publication lists for coffee rust, berry borer, plant breeding, coffee nutrition, etc. as supplemental additional libraries for research on these topics in selected countries.

e. Funds should be provided by national institutions to build up their coffee libraries and train technicians in the use of available literature.

f. The IICA, CATIE librarians should train national counterparts to manage their national coffee libraries and draw on the CATIE/IICA library for specialized publications via photocopies.

I. EVALUATION PROCEDURE

A. Evaluation Team

ROCAP Project No. 596-0090, "Regional Coffee Pest Control" has called for a final evaluation of the activities and operations of this project. To accomplish this, ROCAP employed the following people with extensive experience in coffee, in-depth knowledge of the Central American region and knowledge of the institutions involved in this project nationally and regionally, to carry out this activity:

1. Dr. Silvio Echeverri
   Director, CENICAFE
   Chichiná, Colombia

2. Mr. Donald R. Fiester
   Agricultural Consultant
   Annandale, Virginia

3. Mr. Robert McColaugh
   Deputy Regional Agricultural
   Development Officer
   AID/REDSO
   Nairobi, Kenya

Robert McColaugh participated as a collaboration from REDSO/East Africa to ROCAP.

B. Evaluation Methodology

The evaluation team was charged with the following actions:

1) Review project documents, including the project paper, annual work plans, quarterly status reprorts, prior evaluation reports, technical reports, manuals and any other project documents, in order to measure compliance with project purpose and outputs.

2) Interview personnel from the National Coffee Research Institutes in each of the Central American countries (excluding Nicaragua), project technicians, and visit field sites where experiments have been conducted for control of rust, bean borer and development of rust resistant varieties.

3) Inspect the facilities constructed under the project, the coffee processing plant and tissue culture laboratory at CATIE in Turrialba, Costa Ria, and greenhouses in El Salvador, Guatemala and CATIE, to see how they are functioning, the use that is being given to them and if they have contributed to the research activities,of the different project components.

4) Examine the amount of counterpart contributions of the six Central America/Panama countries and of IICA and the commitment of the countries to continue project activities.

C. Analytical Procedure

The three man team began its work in Costa Rica on March 2, 1987. To carry out this evaluation, the team adopted a work plan including the following:

1. Analysis of the frame of reference of the IICA/PROMECAFE - AID/ROCAP Project.

2. Study and analysis of the "Documento Base Informativo y Analítico" relative to the design, objectives, and progress of Project 596-0090, which was prepared to assist and guide the team in the evaluation of the Project.

3. Assemble and analyze verbal and written information provided by national and international institutions and persons connected with the Project.

4. Preparation of the final report by the evaluation team relative to the results obtained on the evaluation of IICA/PROMECAFE-AID/ROCAP Project No. 596-0090.

A meeting was held with the ROCAP Project Officer, Miss Nancy Fong and Dr. Carlos Enrique Fernández, Director of PROMECAFE/IICA on the proposed approach to the evaluation. This was followed by an initial review of the extensive set of project management, financial, technical and methodological publications developed since the project was formally initiated in August 1981.

During March 2 and 3 in Costa Rica, the team met with the senior staff of the Interamerican Institute for Cooperation in Agriculture (IICA). On March 4th, the team travelled to the Tropical Agricultural Research and Training Center (CATIE) to see the installations, discuss project activities and review the field trials being carried out at that center and on private farms. On March 6, the team met with the USAID

Program Officer and the Senior Researchers of the Instituto de Café and the Ministry of Agriculture at its Center near Barba, Costa Rica; reviewed the field research and their processing plant.

On March 9, the team travelled to El Salvador, met with the research and technical transfer staff, saw the field research and laboratory facilities financed under the project. An in-depth review was made of the technical transfer program including discussions with small farmers. A meeting was also held with the USAID Agricultural Officer and several members of his staff.

In Guatemala, during March 13 and 14, the team visited PROCAP, IICA, The Central Office of ANACAFE, and met with the Director of the "Comisión Roya". On March 16th, the team visited the ANACAFE Coffee Experiment Station near Retalhuleu. One member of the team spent a day in the field with the ANACAFE information transfer team while the other two visited broca research near Mazatenango and discussed progress and problems of the residue analysis being carried out by ICAITI.

On March 19, the team visited in Honduras the Central Officer of IHCAFE, IICA and USAID/Honduras. The next day was spent in the field reviewing the variety trials, the credit and information program and the Coffee Experiment Station near La Fe.

On March 21, the team traveled overland to Boquete, Panama from Costa Rica, to review the field trials and the information transfer program at the Boquete and Rio Salero Centers.

Completing the fieldwork on March 24, the team met with IICA's Director General. The extensive literature generated by the project was reviewed and collectively the team analyzed the progress and problems of the project and prepared the final report.

Dr. Echeverri made a formal presentation of the evaluation to the IICA staff on April 2, 1987. Mr. Fiester presented a similar analysis to ROCAP on April 3, in Guatemala.

II. BACKGROUND TO PROJECT EVALUATION

A. Setting

Coffee is the single most important agricultural export crop of Central America, Mexico, Panama and the Dominican Republic. The area grows coffee on more than one million hectares of land, producing over thirteen million sacks (one sack=60 kg. or 132 lbs.) of coffee and employs an estimated two and one half million people in the region's rural sector (an estimated 35% of the rural labor force). Sale of coffee from the area in the 1986/87 crop year generated an estimated U.S.$ 1.32 billion dollars of foreign exchange. The countries of this region collectively constitute the second largest source of exportable coffee, only surpassed by Brazil.

As a result of the decrease in the world market price in the late 1970's, the countries found themselves also faced with two new major pests. Coffee Rust (Hemileia vastatrix) had entered Nicaragua in 1976 and the Coffee Broca (Hypothenemus hampei) in Guatemala in 1971.

A major effort was made by the Nicaraguan government in the early 1970's to contain and eradicate the rust in the secondary production area where it was found. These efforts were almost successful when the country was embroiled in a civil war.

Coffee rust after its initial introduction, quickly spread into the major coffee area of that country and is now found in all of the countries of the region. In some, as yet, the level of infection is relatively light, while in others it has become a significant

factor in production. The cost of spraying for the disease and the amount of loss in production is extremely difficult to estimate since data are not maintained on these losses and costs by member countries. It can be safely predicted that had control measures not been taken by producers throughout the area, the loss in production today would have exceeded 20% of exportable production or some 250 million dollars annually.

Broca since its appearance in Guatemala, has spread slowly but steadily. It is now found infesting the major coffee areas in Guatemala, El Salvador and Honduras. Since it is found on the Honduras/Nicaraguan border, the pest is presumed to also be in Nicaragua at this time. However, it has not been officially reported by that country. Losses due to Broca vary by farm and even within farms in a given area. In the worst infestation areas of Guatemala, losses of 60-75% of the exportable production in given years are not uncommon. All coffee grown throughout the region is C. arabica and is totally susceptible to both of these pests.

Because of the concern for the economic and social consequences of these major new threats to the industry and a desire to form a regional network of coffee researchers and information specialists to modernize the region's coffee production, PROMECAFE was created in 1979.

PROMECAFE's headquarters are located in the Instituto Interamericano de Cooperación para la Agricultura (IICA) San José, Costa Rica. It signed a general working agreement with each member country and sub-agreements with the Centro Agronómico Tropical de Investigación y Enseñanza at Turrialba, Costa Rica, as well as with the Organización Internacional Regional de Sanidad Agropecuaria

(OIRSA) in El Salvador, for supporting studies and assistance by these specialized regional institutions.

The basic financial support for PROMECAFE is from an annual contribution of US$20,000.00 by each member country. This is paid by either the Ministry of Agriculture or the National Coffee Office of the member countries in accordance with the internal agreement of each nation. The salary of the Program Director and the cost of the Office facilities are paid by IICA from its budget.

PROMECAFE's overall management is directed by an IICA Agricultural Scientist (Dr. Carlos Enrique Fernández) who has had extensive experience in coffee research and production. In addition, two other professionals are employed with PROMECAFE country contributions. One works in Agricultural Communications (Lic. Eduardo Andrade) and a second specialist in Agricultural Research (Ing. Jorge Hernán Echeverri). The first is stationed in San José and the latter is headquartered at CATIE. In addition, the country contributions initially financed two secretaries which later was expanded to three support people. In 1984, PROMECAFE with its own funds, employed a Coordinator and his secretary to supervise the program's work in the Dominican Republic (Ing. Agr. Raúl Pineda). With funds derived from the ROCAP/IICA Coffee Pest Control Project overhead, IICA has employed a Project Management Specialist (Ing. Agr. Carlos Arauz).

PROMECAFE is a multinational program of IICA and the Central America/Panama, Dominican Republic, and Mexico member countries. It was created to foster the improvement of coffee culture in the region. Basically, this initiative was focused by the participants, on the improvement of coffee production regionwide and the solution of specific common problems such as coffee rust,

broca and others. The initial agreement creating PROMECAFE was for a five years period, starting in January 1978. It was later extended to December 1987 by mutual agreement of the countries and IICA (February 18, 1983).

B. The ROCAP/PROMECAFE Regional Coffee Pest Control Project

In 1980, ROCAP was requested by the participating countries to consider support for an expanded PROMECAFE effort to confront coffee rust and broca, since these major problems and their effect on production were beginning to reduce foreign exchange generation by the member countries, as well as seriously decreasing the potential of small producers to continue to earn a significant portion of family income from coffee.

On June 5, 1981, AID/ROCAP and IICA, representing the PROMECAFE participating countries, signed a Grant Agreement for a Regional Coffee Pest Control Project No. 596-0090. The Conditions Precedent to the initial disbursement were met by IICA and the member countries in December 1981. The project began its formal operations in January 1982.

The project was programmed to be operational for a five year period or until May 31, 1986. At the request of IICA, ROCAP granted a no cost extension for one year and then for seven additional months until December 31, 1987, using funds not spent during the initial period.

As determined in the Project Paper and amplified in operational terms, this project has the following elements:

1. Project purpose:

The purpose of this project is "to develop an integrated

system employing the combined efforts of regional and national institutions to help control the spread of coffee rust and other coffee pests, particularly as they affect small coffee producers".

2. Goal:

The goal of the project is "to increase the incomes of small coffee farmers in Central America".

3. Project Outputs:

The primary focus of the project is research on coffee pest problems, particularly rust and how its effects can be controlled.

4. General End-of-Project Status:

a) National Institutions will be conducting production system and transfer research as developed in conjunction with regional institutions.

b) Trained personnel in regional and national institutions will be performing increased experiments and field trials related to coffee pest problems.

c) Modes and methodologies for application of research results to the small farmer situation will have been developed and tested.

d) A system of insecticide standardization, residue level and registration will have been adopted region-wide.

X 50

e) Improved rust resistant coffee seeds will be produced and disseminated through national institutions to small farmers.

The major activities of the ROCAP/PROMECAFE Project include various major elements focused on actions which, if successful, were considered most important in reducing the threat of coffee rust, broca, pesticide management, residue considerations, etc., through fundamental and applied research, information transfer, and training.

The ROCAP Project supports seven main activities that contribute to minimizing such limiting factors when the Project terminates. These activities, when the project is completed, includes the following:

1. Introduction of high yielding rust resistant coffee plants to enable the different countries to select two or three varieties for distribution to small coffee growers.

2. Study of the biology, epidemiology and control of coffee rust with the purpose of determining the use of more appropriate fungicides, their dosage, time and number of applications and equipment to attain a more adequate and economic control of the disease.

3. Study of the biology, epidemiology and control of the coffee bean borer to determine the best practices in order to combine, if possible, cultural practices with biological and chemical control using the best practices, in order to combine, if possible, cultural practices with biological and chemical control.

4. Analysis of residues for the recording and control of pesticides used in coffee with the purpose of developing uniform regional methods for this activity.

5. Training of technical and auxiliary personnel from national coffee organizations with the purpose of overcoming the present shortage.

6. Generation, development, adaptation and transfer of appropriate technology for the rapid and practical incorporation by small producers to increase their income through modernization of coffee growing.

7. Development of a regional information system and a data bank that will serve as a technical reference source for personnel from countries participating in the PROMECAFE/ROCAP Project.

III. PROJECT ACTIVITIES AND COMPONENTS

A. Introduction to Project Components

This section of the final evaluation attempts to measure achievements and impact for each project output or activity against the Logical Framework matrix, implementation plans and the amplified project description. As pointed out in the background section above, PROMECAFE was launched in 1978 to promote, through regional cooperation, agronomic research and the development of improved technologies for coffee production.

The advent of rust and broca outbreaks prompted PROMECAFE to seek additional donor assistance to combat these two major threats to coffee production in the Central American Region. The constraints identified at that time which required PROMECAFE, in combination with CATIE and OIRSA, to obtain outside assistance were identified as:

1) Economic conditions in the region resulting in insufficient funds to finance the required research efforts,

2) A shortage of trained local personnel to deal effectively with these coffee pests, and,

3) Lack of tested high yielding varieties known to be resistant to rust.

B. Assumptions

The assumptions upon which this regional networking project was

developed, and those which have been used to measure the impact and achievements of the project in this final evaluation were:

a. Coffee rust, if left uncontrolled, would have devastating effect on the region's coffee production.

b. Technification of coffee cultivation was the most promising and feasible strategy available to address the problem. The development of suitable high-yielding and rust-resistant varieties was to be an essential aspect of the technification.

c. The development and testing of rust resistant varieties could be done most effectively by regional institutions working in close cooperation with national research institutions. There were economies of scale in encouraging regional efforts, since the regional institutions were in the best position to provide guidance and coordinate the efforts of the national institutions. They were also best able to provide training to technical personnel.

d. The national governments were prepared to carry out major programs to technify coffee farms in their countries and were willing to significantly expand the financial resources devoted to that purpose. They also would make a special effort to reach small farmers as these were most in need of technical assistance and credit.

e. The international financial institutions-IDB, CABEI and the IBRD-were interested in helping the C.A. governments to finance their coffee technification programs, provided that well justified, bankable projects were developed.

f. A substantial proportion of the region's small farmers would

be willing to technify their farms if they were offered the necessary credit and given access to essential inputs and technical assistance.

C. Timeframe

Since the project was a problem oriented research and training activity, aimed at developing an economically viable system of coffee technification including coffee rust and broca control, the designed research activities were classified into three timeframes as to when they should provide usable results.

They were:

1. Short Term (2-3 years)

   a. Biology, etiology and epidemiology of the coffee rust fungus known and national technicians trained to monitor the incubation cycles.

   b. Control of broca.

   c. Efficacy of copper based fungicides (i.e., dosage rate, timing, number of applications, methods of application, and evaluation of additives for rust control).

   d. Evaluation of spraying equipment.

   e. Formulation and initial testing of improved production packages (e.g., control of shade, fertilization, water, pruning, spraying, etc.).

f. Development of socio-economic profiles of regional coffee farmers.

g. Expansion of the regional data/information bank.

2. Medium Term (3-4 years)

a. Efficacy of systemic fungicides and other pesticides.

b. Pesticide tolerance and residue analysis for new pesticides, particularly systemic fungicides.

c. Recommendations for pesticide registration and use.

d. Development of appropriate methods for technology transfer to small farmers.

3. Long term (4-10 years)

a. Development of high yielding, rust resistant varieties.

b. Multiplication and distribution of improved varieties.

D. Project Components

The following is a review of the present status of each of the project activities and components. The review team attempted in each case to measure impact, constraints and achievements. Recommendations and conclusions are provided by output as well as summarized later in the text.

1. EPIDEMIOLOGY OF RUST

a. Research and Extension Activities

The philosophy for the creation of PROMECAFE responds to the interest of the member countries to face up to, in a collective sense, two serious problems that especially affect small producers. These are Coffee Rust (Hemileia vastatrix Berk & Br.) and Coffee Barry Borer (Hypothenemus hampei found in the region in 1976 and 1971. This section refers to the research problems of rust and especially the way in which it has been addressed, reasearchwise.

In general, in the areas of Central America visited by the evaluation team, there is considerable concern about coffee rust and broca. Thanks to the research work carried out by Dr. Zia Javed in collaboration with national researchers in the region and especially the Salvadorean technical staff, there is considerable clarity in the focus and scope of the problem. A research methodology and epidemiological studies of rust that can be applied throughout the area is available and there are very good results from the use of copper based fungicides, particularly oxichlorides and oxides of copper to control the fungus. Several later sections of this report refer to the research problems of rust and especially the way in which it has been addressed.

In addition, a brief description of the situation in each country that the evaluation team visited, is presented.

El Salvador

El Salvador is the country that appears to be most advanced in rust research. The epidemiological curves have been well identified. This has resulted in a decrease in the number of spray applications to three and in some cases two, with a concurrent decrease in the recommended dosage of Copper Oxichloride from 3.0 kg./ha. to 1.5 kg/ha. per application. Test results of copper fungicides compared with systemic fungicides have shown an advantage for the former as regards their effectiveness in controlling the disease as well as their cost of application.

There still remains a doubt on the source of fungicide residues (see section D), particularly that of metalic lead, which presumably results from the basic compounds used in the manufacture of these fungicides. The present evidence indicates that this is not a clear picture of the real source and importance of this finding, since the chemical analyses do not provide significant differences between treated and untreated plants. For this reason, it is recommended that further study and analysis be made on the content of copper and lead in the beverage and identify the sources of this contamination.

It should be pointed out that results on both the epidemiology of rust as well as the application of fungicides have been carried out in the laboratory as well as in the field, thanks to the excellent leadership of Dr. Zia Javed and the excellent collaboration of the

entire staff of ISIC. They also identified the presence of race II of Hemileia vastatrix Berk & Br. and are now able to detect some other rust races through testing with indicator plants.

The research facilities of ISIC have been greatly improved through the purchase by PROMECAFE, of laboratory equipment and a greenhouse, which are now in use (See III c.).

It is important to mention that ISIC has carried out preliminary testing of manual and motorized sprayers. This testing has been useful in advising producers on the best equipment to purchase. However, there is still a lack of adequate equipment and training to do thorough research in this area.

In the visit to OIRSA, it was verified that during the operational period of this project, they have not made any significant contribution to PROMECAFE as originally planned due to the financial problems experienced by that institution as well a. its technical capacity limitations.

Guatemala

Guatemala was assigned responsibility for the control and management of coffee rust through the Commission for Coffee Rust of that country, which was established with the financial and technical collaboration of the Government of Mexico. Initially, tests were conducted on copper fungicides for the control of the disease and epidemiological studies were carried out using the

methodology proposed by Dr. Kushalappa. These efforts were principally directed toward small producers, to whom they also sold fungicides at subsidized prices.

At present, the Commission is studying the possibility of converting itself into a promotional agency for crop diversification in coffee zones, taking advantage of the administrative flexibility inherent in its status of an international organization. The Project Evaluation Team did not have the opportunity to review the research program of the Commission.

Honduras

In Honduras the research program is carried out in four regional experiment stations of which the La Fe Station is the most important and in which the main soils, pathology, and entomology laboratories are located in support of their overall research program. As regards rust, they have not maintained close contact with ISIC in so far as rust epidemiology is concerned. Nevertheless, in the opinion of Dr. Javed, the rust epidemiological orientation of the Honduras program has benefitted from exchange of views with other countries which has permitted them to better guide their research and improve the results they are now obtaining. Beyond the ongoing research program in rust, which has the highest priority, the pathology laboratory facilities are also used to make diagnosis and control recommendations on other common diseases of coffee in Honduras.

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Costa Rica

Even though Costa Rica is a member of PROMECAFE, they have not had a major role in the research program emphasized by this organization. Nevertheless, it is recognized that they have had very valuable success in general coffee research and they have provided a considerable amount of training to people from other member countries. The Costa Rican researchers interviewed by the Evaluation team expressed an interest in becoming more involved in rust and coffee berry borer research, in a collaborative mode, with other technician in the region.

On those aspects related to the control of rust, the cooperative program between the Costa Rican Coffee Institute and the Ministry of Agriculture (ICAFE-MAG) were visited by Dr. Javed in 1984. He left them with a set of excellent recommendations. It was not mentioned if they had followed these suggestions.

Up to the present, the incidence of rust has not been high in the country. This has been thought to be due to the initial low level of the disease's incidence and the long history of Costa Rican producers applying fungicides to control other diseases in their plantations.

At present, the Coffee Institute does not have a pathologist and the rust problem does not appear to concern them very much.

Panama

During the time that the Evaluation Team visited Panama, rust had been found only in the area of Cerro Azul, a marginal coffee area with high rainfall. Due to the training provided by PROMECAFE, the staff of the Coffee Program of MIDA were able to rapidly and effectively act to keep the rust situation under control. At present, the disease has not been found in the main coffee zone of Chiriquí and it appears that the Panamanian team has had adequate training to confront the problem adequately, once it is found in this region.

b. Recommendations

i. Two or three ISIC researchers should be trained in the techniques of fungicide application in the Overseas Spraying Machinery Center, Imperial College, University of London. When trained, it would be useful that they secure and equip a laboratory to test spray equipment that could benefit the entire region as well as serve as a research and training center, thus assisting in information transfer.

ii. It is imperative that the program employ a senior coffee pathologist to fill the void left by Dr. Zia Javed's departure. The work begun by this scientist must be continued, not only in El Salvador but also extend his work to the rest of the region in order to strengthen overall rust research. It is important that this work be guided by a master plan for the

entire region that is compatible with the work completed to date in ISIC. The need to strengthen this line of research is especially needed in Guatemala and Panama. In the latter country, now that rust exists within Panama, it is essential that they study the life cycle of this disease as it expands into new areas.

iii. The above recommendation should be backed by further institutional and financial support for ISIC, the lead institution in rust research so that their work can continue under the best possible conditions.

2. BROCA CONTROL

a. Background

The coffee berry borer (Hypothenemus hampei Ferr.) is a major insect problem in Africa. It was introduced into Brasil in the 1930's where it caused major losses in certain regions of the country. The insect was first identified in Guatemala in 1971, where early attempts to control it were unsuccessful. Probably from this initial Guatemalan infestation, Broca spread into Honduras in 1977, then to Mexico in 1978 and to El Salvador in 1981. It is also found in Jamaica and Puerto Rico.

The coffee berry borer, after its initial introduction into an area, multiplies rapidly and spreads to adjacent coffee trees until the entire area is infested. The female insect eats a small hole in the flower or distal end of the growing coffee cherry (green or ripe) and works her way through the pulp and parchment into the

seed. She then makes galleries in the seed and lays one to six eggs.

The larva breaks out of the eggs in a few days and begins eating the seed until it pupates. It, somewhat later, evolves into mature insects in a ratio of one male to about ten females. The female insects mate in the fruit and soon after leave it to fly to other fruit to repeat the cycle. From egg to mature female ready to leave the fruit, requires about 30 days per cycle. Mature females live approximately 157 days under good ecological conditions and may lay an average of seventy-five eggs during the latter 118 days of their life. The most prolific female studied in Guatemala, lived 282 days and produced 117 eggs.

Losses due to this insect vary with ecological, cultural and control conditions in different infested areas and farms. In Guatemala, infestations of fruit have been as high as 83-100% of the crop in certain farms where no control measures have been practiced. When the infestation and seed foraging of the insect is high, the seed dries and the fruit falls on the ground. This results in both loss of fruit on the tree and loss of net weight of beans of exportable quality.

Losses of exportable production in certain processing plants, in years of heavy infestation, have been as high as 59 percent with more normal loss rates in the range of 5 to 20%.

All commercial types of coffee including C. arabica and

C. canephora are susceptible. Only C. Liberica is not attacked by this insect due to the tough epidermis of its fruit. No resistance or even partial resistance have been reported for any individual C. arabica plants in commercial production.

b. Broca Control Research Under the Project

Because of the major losses being reported in areas where broca has become well established (e.g. Guatemala, El Salvador and Honduras), the ROCAP/IICA Regional Coffee Pest Control Project included as objective (2) research on this pest. The grant agreement called for IICA to sign a bilateral agreement with OIRSA and delegate that OIRSA conduct laboratory, greenhouse and field studies on the coffee berry borer (broca) as well as efficacy studies on acceptable insecticides and promising biological controls.

These studies were to be conducted in collaboration with national research agencies. Coffee berry samples from treated plots were to be analized for residues under a sub-project agreement with ICAITI or other qualified laboratories. OIRSA and PROMECAFE would utilize the research findings to jointly develop training materials and training courses for national level technicians.

Research data and information generated were to be stored in the regional data/information bank at IICA and be made available to national agencies"..."By the end of the project, efficient chemical and/or biological control and cultural management schedules for the control of broca were to have been developed and made available to national programs throughout the region.

c. Program Activities and Results

The broca control research prgram has not evolved as rapidly as the other elements of the project. In accordance with the conditions prior to disbursement under the project, IICA signed an agreement with OIRSA, to provide most of the basic research studies on the insects biology, life cycle and field control. OIRSA soon realized that it could not carry out its commitment due to financial limitations and the lack of appropriate technical specialists on its staff.

As a consequence, a project entomologist was employed by IICA, shortly after the project began. In less than one year, this technician resigned to accept another position. His loss, plus the long period required by IICA to identify a suitable replacement and approve his employment under the project, resulted in the loss of almost two years of work on this important phase of the program.

The program now has one regional entomologist located in Guatemala that spends part of his time advising on broca research in Honduras and El Salvador. In addition, the IRCC of France has assigned an outstanding research entomologist in Guatemala as an integrated member (and advisor) to the broca research group of that country. His technical competence and leadership has been extremely effective in organizing and managing the Guatemalan broca control program.
PROMECAFE has provided the essential research and laboratory equipment in Guatemala, El Salvador and Honduras for the program and two large greenhouses and headhouses in El Salvador and Guatemala. The investments in laboratory and

weather station equipment has been well spent and appear to be effectively used by project personnel.

The only exception to the above has been the greenhouses. The El Salvador greenhouse was completed in early 1986 and the Guatemala greenhouse in July, 1987 although they were purchased in 1984. Neither of these two facilities are as yet fully operational due to delays in their construction and the extremely high temperatures being generated in them. The inadequacy of the conventional air drainage in these units must be modified before they can become completely functional.

Since mid 1984, the broca control research and development program has made satisfactory progress through field studies, short courses, workshops and symposiums. Technicians from all of the member countries have received training on the insects' damage to coffee, broca morphology, ecology, population dynamics and control procedures based on studies carried out in different parts of the world. Each country now has two to over ten technicians conversant on most phases of the insects life cycle, control methods, research procedures and are transferring the information, as well as new regional research findings, to extension agents and producers.

Field and laboratory research has focused initially on ascertaining if the life cycle of the insect in Central America follows the general parameters of work done in other parts of the world under different ecological conditions. These results have, in general, been found to be sufficiently analagous to serve as the basis for studies on population dynamics and control.

An aggressive series of studies have been completed on the use of chemicals to control the insect before it is able to enter the fruit. Research in other infested countries resulted in 1981 recommendations of five to eight sprays of "Endosulfán" (Thiodan) at the rate of 1.5-2.0 kg. per hectare. As a result of research conducted in Guatemala and El Salvador, it has been shown that one to three applications of "Endosulfán" at 0.75-1.0 kg. per hectare, if applied at the proper time, will provide satisfactory control under most Central American conditions.

These results appear to reduce spray costs and environmental contamination. Work is now in progress to evaluate the actual economic benefits of the reduced frequency and amount of insecticide applied. Concurrently, research is moving ahead to index the level of broca infestation in Guatemala's coffee areas and determine the economic threshold for chemical control on low, medium and high yielding plantations.

Other research has followed on findings from Kenya that show that proper plantation sanitation can materially reduce broca infestation. Recent work in Guatemala has demonstrated that picking up fruit that has fallen on the ground and ripe fruit on late blooming coffee trees, at the end of the season, reduces the "over wintering" of broca populations. The removal of this source of "over wintering" can further reduce the need for spraying to one or two applications per season, if they are carried out effectively at the proper time. This work may offer the small producer a low cost control measure that may, if properly carried out eliminate the need for chemical control during most years.

To date some twenty-eight different insecticides have been screened in the laboratory and in the field, for their efficacy in controlling broca. Of these, only "Endosulfán" hasbeen found to give satisfactory control of this insect. The lack of alternate chemicals for broca control provides one company with almost a monopoly insecticide. In addition, there is the real possibility that broca may develop genetic resistance to this insecticide and open up a new round of major infestation.

The IRCC has financed a M.Sc. level thesis for a Costa Rican entomologist during 1986-7. This person is working in Togo for one year collecting broca predators in that country and conducting preliminary screening of them for possible later introduction and testing in the PROMECAFE region.

Almost concurrently, the Mexican broca team is introducing several potential predators (April-May 1987) into Mexico for laboratory study. Hopefully from these efforts, some biological control of this important insect can be found to further reduce the damage it causes.

d. Observations and Conclusions

The field broca research reviewed by the team principally in Guatemala, where most of the fieldwork is being carried out, appears to be well conceptualized, designed and executed.

It has been noted that for this and all other research carried out under the project, the researchers are not using the best plant nutrition on the experimental trees. The trees in

experiments seen, almost without exception, show rather severe deficiencies of nitrogen, magnesium, boron and zinc. The effect of these nutritional problems on the incidence and control of broca cannot be determined. They should be corrected using either foliar or soil application (or both) as soon as possible. Good research, especially on private farms should use the best cultural practices possible or producers will have less than full confidence in the research results obtained.

Differences noted between the status of ongoing broca research and their understanding of the cost effectiveness of control measures among both research and information transfer technicians in Guatemala, Honduras and El Salvador, lead the evaluation team to suggest that current methods of economic analysis and its use information exchanges can and should be further strengthened.

As new information becomes available from applied research, existing teck-packs should be revised and the new recommendations quickly made available to small and large producers.

Further research is urgently required to determine the economic costs incurred by broca infestations in commercial plantations. Likewise, additional research is needed on the cost/benefit of chemical and sanitation control as well as when each practice is most effective on small, medium and large farms. It should also be evaluated when production and market prices are low or high. This will permit improving the broca control recommendations now being given to producers.

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A method for field sampling fruit to determine the level of infestation and when and where, in the plantation, control measures should be undertaken is now in progress. Through the research proposed in the paragraph above and farmers educated to sample their fields and determine when spray applications are economically advisable, control can be made at reduced cost to both small and large producers. This work should be aggressively pursued by the broca research teams, in the three countries, as soon as feasible.

The fact that present chemical control measures depend on only one insecticide is very risky. At any time the manufacturer can raise the price of this product or the insect can become tolerant of it. Further screening of as many insecticides as feasible is urgently needed.

Further strengthening of coordination among Guatemala, El Salvador and Honduras broca researchers and their activities is badly needed. They should meet at least every four to six months to discuss their progress as well as probably design complementary studies within an overall plan of work. Duplication and gaps in the program should be identified and corrected, during these sessions.

The research on broca predators should be actively supported by PROMECAFE. However, the results of this work will not become operationally useful for many years. Since Mexico has the best facilities and trained personnel for this type of investigation, it should become the major regional center for coffee bean borer biological control studies.

The testing of promising new insecticides should be continued, as at present, primarily through collaboration between PROMECAFE, Guatemala and El Salvador programs, and ICAITI.

The evaluation team has been impressed with the excellent leadership, technical capacity and collaborative style of Dr. Bernard Decazy, Broca Entomologist provided by the IRCC and his contribution to this program. It would not have advanced as far as it has without his help. It is noted that he is scheduled to return to France at the end of 1987. PROMECAFE and its member countries should formally request an extension of his services or a one year overlap with another IRCC entomologist, so that the present momentum of the program can be maintained.

3. RESIDUE ANALYSIS AND CONTROL/REGISTRATION OF PESTICIDES

a. Analysis of Residues

In accordance with the terms of the Project Agreement between USAID and IICA, OIRSA was selected as the lead institution responsible for the analysis of residues for the control and registry of pesticides. Due to internal problems, mentioned in the 1984 mid-term evaluation of this project, OIRSA could not complete any part of its responsibility. This was the reason PROMECAFE requested the assistance of an expert in the chemistry and regulation of pesticide residues to reorient this element of the project. The report prepared by Dr. Cummings, a U.S.D.A./E.A.P. pesticide chemistry advisor, was presented to IICA/Washington D.C., on the completion of his study.

The report of Dr. Cummings suggested that the University of Costa Rica was qualified to carry out these residue tests, as was the Central American Institute for Industrial Technology (ICAITI), the National Center for Agricultural Technology (CENTA) in El Salvador and the Salvadorenean Coffee Research Center (ISIC), also in Salvador.

The Evaluation Commission of 1984 recommended that both the project plant pathologist and entomologist accept the report of Mr. Cummings and move forward in carrying out the analysis of residues. To accomplish this, two technicians were sent from ISIC to take a three month course at the University of Miami. The course began in April 1985 to train these technicians in the analysis of residues, so that they could be made responsible for the analysis in coffee.

Upon completion of the course, these technicians requested that specialized equipment be purchased so that they could analize for lead, copper and fungicides. This equipment arrived in El Salvador in 1985 as part of the donation of PROMECAFE to that country's research program. They also requested that analytical standard chemicals for oxycarboxin and "Endosulfán" be secured from the EPA. It was decided by PROMECAFE that these analysis be carried out both in ISIC in El Salvador and ICAITI in Guatemala.

The samples were taken from six experiments in El Salvador, Honduras and Guatemala and analized using the International

Codex Alimentarius procedures of the F.A.O. The compounds analized were:

Copper Oxichloride 50% W.P.
Cuprus Oxide 50% W.P.
Bayleton 35% W.P.
Bayleton 25% W.P.
Tilt 25% E.C.
Thiodan 35% E.C.
Malathion 57% E.C.

Because of administrative problems in ISIC, their laboratory could not carry out the analysis as planned. For this reason, the available analytical results are those generated by ICAITI. All of the coffee bean samples taken from the experiments with treatments using copper fungicides of 50% W.P. resulted in lead residues (between 0.50 and 0.70 mg/kg). Almost all the copper fungicides analized had lead in their formulation.

It is not known if the lead found in the coffee bean came from the root system or is absorbed through the leaves of the plant. This indicates that it is urgent to continue research on lead contamination in the coffee bean. In the analysis carried out by ICAITI, residues of Bayleton (Triademephon), Malathion and "Endosulfán" were also detected. None of these pesticides used on coffee have approved tolerance standards established by international organizations.

The residue levels found in theses samples, are considered high when compared with other products on which maximum tolerance levels have been established. These high levels may

affect coffee trade in the future for Central American Coffee. In the case of 50% W.P. copper fungicides, their lead content should not exceed 250 ppm, the level approved by F.A.O. Some of the 50% W.P. copper fungicides now used in coffee to combat coffee rust have as much as 5000 ppm, of lead in their formulation.

Each of the countries should develop a capacity to determine the quality of pesticides which are sold to coffee producers to control pests and diseases that affect coffee.

b. Recommendations

1. There still remains a large number of coffee samples to be analized for pesticide residues. These analyses should be completed in order to have better information on the regional trials.

2. PROMECAFE should send duplicates of these samples to other laboratories in the areas, in order to standardize analytical methods and assure comparable regionwide results.

3. Concurrently, it is important to analize the residue level of pesticides in the cup of coffee. This analysis should then be correlated with the bean analysis in order to better determine the limits of tolerance and their relationship with these compounds.

4. The present analytical procedures for determining pesticide residues should be better calibrated for the intrinsic characteristics of the coffee bean, since they

have exceedingly high levels of fats and a large number of organics compounds responsible for the inherent quality of coffee.

4. HIGH YIELDING RESISTANT COFFEE VARIETIES

a. Plant Improvement Program

1. Activity Objectives

The focus of this activity in the IICA-PROMECAFE/ROCAP Project are to:

- Develop rust resistant strains of coffee which can be substituted for susceptible cultivars now grown without sacrificing yield, quality or uniformity.

- To develop methodologies and techniques to multiply and distribute rust resistant planting material as rapidly as possible to coffee producers of member countries.

- Develop two to five of the best cultivars to the point of release to producers by the end of this project in 1987.

2. Background

In 1982, at the beginning of this project, some progress had been made at CATIE and in the participating countries in the introduction of potentially high yielding and disease resistant cultivars of coffee. CATIE's coffee collection was already considered one of the largest in

the world. It consisted of some eight to ten species of coffee and a large number (approximately 1000) of C. arabica selections based on morphological and/or rust resistant characteristics.

Each introduction in the CATIE collection consisted of from four to sixteen plants. Only four replicated experiments were being maintained at CATIE in 1982 and almost all data was collected on the basis of the line or cultivar with almost no data collected on individual plants within cultivars. The CATIE collection contained most of the best commercial varieties known in Brazil, Colombia, etc., plus some crosses made at the Centro Internacional da Ferrugens du Cafeiros at Oeiras, Portugal; The Instituto Agronómico do Sao Paulo, Campiñas, Brazil; The Universidad Federal de Vicosa, Minas Gerais, Brazil; Centro de Investigaciones en Café, Chichiná, Colombia; The Indian Coffee Institute, etc., between rust resistant parents and the known major commercial varieties.

From this collection, high yielding varieties developed in Brazil, Colombia and El Salvador were also distributed by CATIE to national coffee improvement programs throughout the hemisphere. The high yielding types (Caturra, Mundo Novo, Catuai, Bourbon) were quickly multiplied in the Central American countries, after limited field testing in unreplicated observation plots and distributed to growers.

Some 109 rust resistant types, mostly heterozygus F-3 to F-6 progeny from resistant x high yielding variety

crosses from Portugal and Brazil, in the CATIE collection, were sent before 1982 to the national coffee organizations, where they were put into small observation plots on experiment stations in several Central American countries.

Little serious applied research was carried out on this material before 1982 in the PROMECAFE region. With the exception of several technicians in Costa Rica and El Salvador trained in short courses in CATIE, IICA and Brazil, there was little or no expertise in the region trained in coffee production and even less expertise, regionally speaking on coffee plant improvement. However, considerable research was underway in El Salvador (ISIC) on varieties and variety testing. This program was the most advanced in this research field in the entire region.

Only two rust resistant lines (Catimor and Timor hybrid) had been commercially distributed to selected larger producers before 1982. These lines produced less marketable coffee than Caturra and Catuai and proved extremely variable in morphological characteristics. They were thus not acceptable to most commercial growers. Consequently, few farmers had multiplied it and no commercial plantations existed in the region.

Several local non rust resistant selections had been identified in Central America, namely "Pacas" in El Salvador and "Villa Sarchí" in Costa Rica, but no serious selection had been carried out to produce genetically and phenotypically homogeneous sexually propagatable lines.

Nevertheless, they were being grown on some commercial farms in the area.

3. Current Status

Since the initiation of the project, PROMECAFE has held seven regional or national courses or workshops and one Latin American Symposium on the genetic improvement of coffee. In addition, courses on coffee rust and tissue culture have addressed aspects of plant selection, coffee genetic improvement, the genetics of rust resistance and related topics.

All technicians involved in testing and selection of improved and/or rust resistant crosses in the region have attended two or more of these courses. Discussions with national technicians during this evaluation, clearly demonstrated their greatly improved understanding of experimental design, experiment management, data collection procedures, data analyses, disease indexing, etc.

The project has greatly increased national access to new rust resistant plant material and their testing in replicated experiments. Six regional trials containing 426 new rust resistant crosses were packaged at CATIE. Each experimental package is comprised of seed of selected crosses and improved commercial varieties with their experimental design, type of data to be collected, etc. One to three replicates of these regional trials have been planted in each member country. At the present time, the following number of new experiments have been field planted since 1982:

- 25 replicated experiments at CATIE
- 8 replicated experiments by Costa Rica
- 8 replicated experiments by Guatemala
- 8 replicated experiments by Honduras
- 19 replicated experiments by Nicaragua
- 5 replicated experiments by El Salvador
- 3 replicated experiments by Panama
- 12 replicated experiments by Mexico
- 11 replicated experiments by Dominican Republic

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99 TOTAL EXPERIMENTS

Where comparisons of lines and crosses were made on the basis of yield of cherry, at the "per plot" level in the member countries of PROMECAFE before 1982, all variety trials in Costa Rica, El Salvador, Honduras and Panama now collect up to eleven different types of data on a per plant basis, within individual plots each year. Only Guatemala, because of labor limitations, still collects data on a per plot basis.

Data are now collected on weight of ripe cherry, amount of floaters, plant vigor, disease incidence, plant height, etc. In selected trials, where adequate equipment is available (El Salvador, Honduras and Costa Rica), data is also collected on out-turn of clean coffee. Cup quality is also evaluated on selected samples by professional cup testers.

All data thus far are tabulated manually and analized each year (except in Guatemala, where data from one trial has not been analized after three years since the information was collected.) In Honduras, a total of over 200,000 separate

TABLE 1. NEW INTRODUCTIONS RECEIVED BY THE CATIE GERMPLASM BANK

	PORTUGAL CIFC	BRASIL UFV	BRASIL IAC	COLOMBIA	EL SAL. ISIC	USA USDA	FRANCIA IRCC	MEXICO IMECAFE	INDIA	COSTA RICA MAG	COSTA RICA PROMECAFE
1978	--	20	—	—	--	—	—	--	--	--	--
1980	—	—	--	1	--	32	--	5	--	--	--
1981	6	17	—	—	—	—	—	22	6	--	--
1983	—	58	12	--	--	—	--	--	--	--	--
1984	27	—	—	—	12	—	—	--	--	3	20
1985	31	70	4	—	--	—	53	--	--	—	--
1986	32	35	—	1	—	—	68	—	--	--	--
TOTAL	96	200	16	2	12	32	121	27	6	3	20

TOTAL = 535 INTRODUCTIONS RECEIVED BY PROMECAFE BETWEEN 1978 AND 1986

datum are accumulated on 8,000 individual plants annually. At this time, none of the national programs are using computers for data tabulation.

The evaluation team was impressed by the ability of national plant improvement investigators to discuss the focus, goals and operation of their programs. All have greatly benefitted from the PROMECAFE training received and their technical understanding of the work they are doing is very evident.

At the time of this evaluation, the oldest experiments have provided three years of yield data. None of the national programs believe that this is an adequate basis on which to make line or plant selections. Some of this local genetic material was received in 1984 and 1985 for field planting, thus only one or two years of performance data exists at this time on these selections.

Preliminary review of data and reports in El Salvador, Costa Rica and Honduras by the evaluation team shows that some of the individual rust resistant crosses are, after two years of production, outproducing Caturra and/or Catuai (the best commercial varieties now known in the area) by 50-100%. Some individual plants, in the same timeframe, have produced more than 300% of the average yield of the best commercial varieties. (See Graph 1 and 2).

The national plant improvement researchers meet at least annually with the regional program advisors to exchange results, design new trials and discuss mutual problems. These meetings have been very important in maintaining an effective

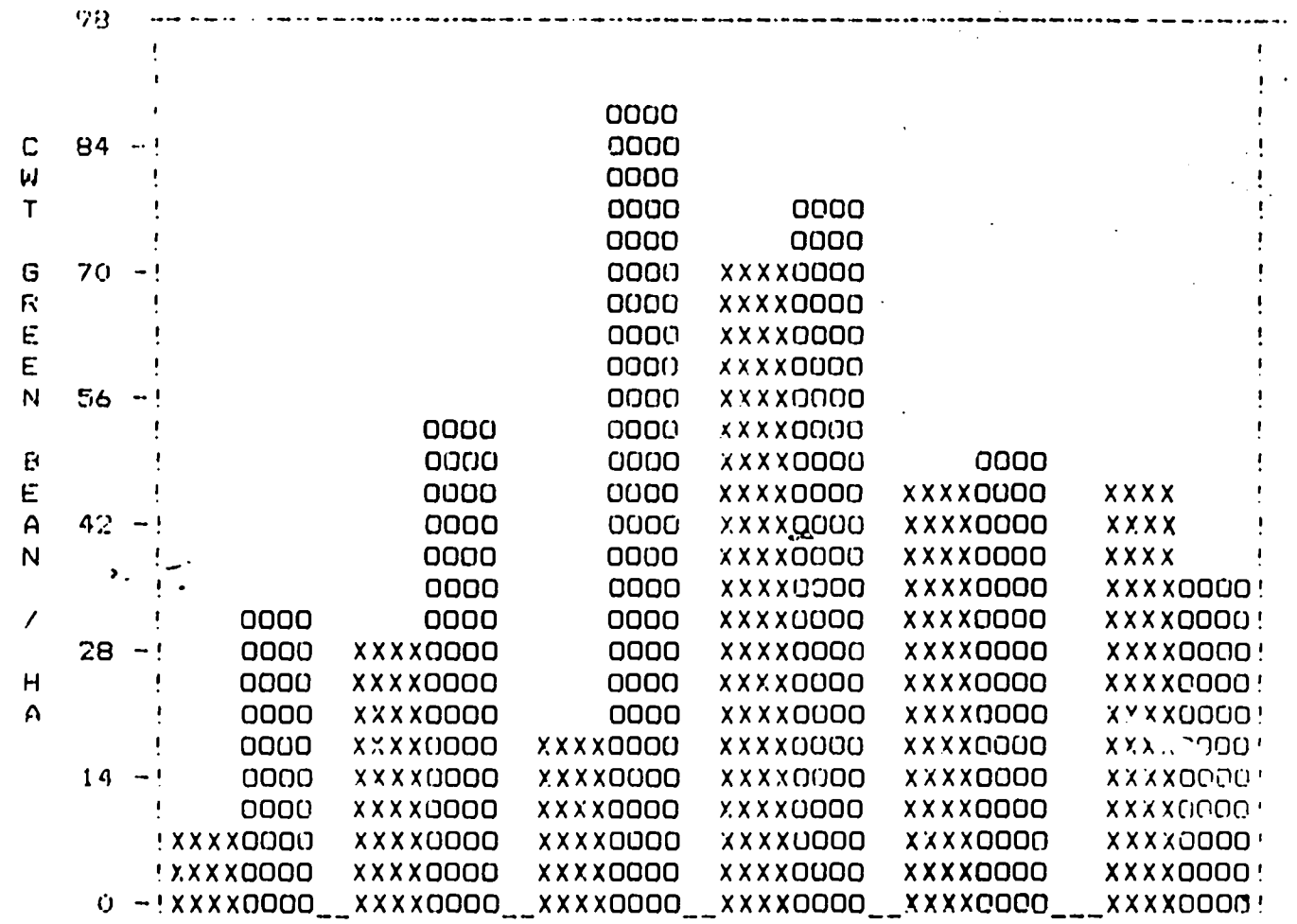
network and improving the capacity of national programs to take advantage of new plant materials being developed at CATIE, as well as in Brazil, Portugal, India, Kenya and Colombia.

PROMECAFE has just developed a computerized program for the tabulation and analysis of plot and individual plant data for all of the experiments operating to date. This new program will be offered through a course in computer operation and data tabulation at CATIE in March-April 1987.

To date, PROMECAFE has not been successful in creating a comprehensive computerized data bank for genetic information collected regionally. IICA did not continue its commitment through PIADIC/CIDIA to maintain a core team of information/data specialists as initially planned in the project. As a result, PROMECAFE has had to pick up the slack and develop the system independently. This new computer program is a part of this effort. PROMECAFE plans to have the system operational, with all national variety testing data, deposited in the central data bank by the end of 1987.

GRAFF 1. PRODUCTION OF COMERCIAL AND RUST RESISTANT LINES OF COFFEE

MEAN FOR 4030 PLANTS/HA



TREATMENTS

XXX 1985/86 000 1986/87

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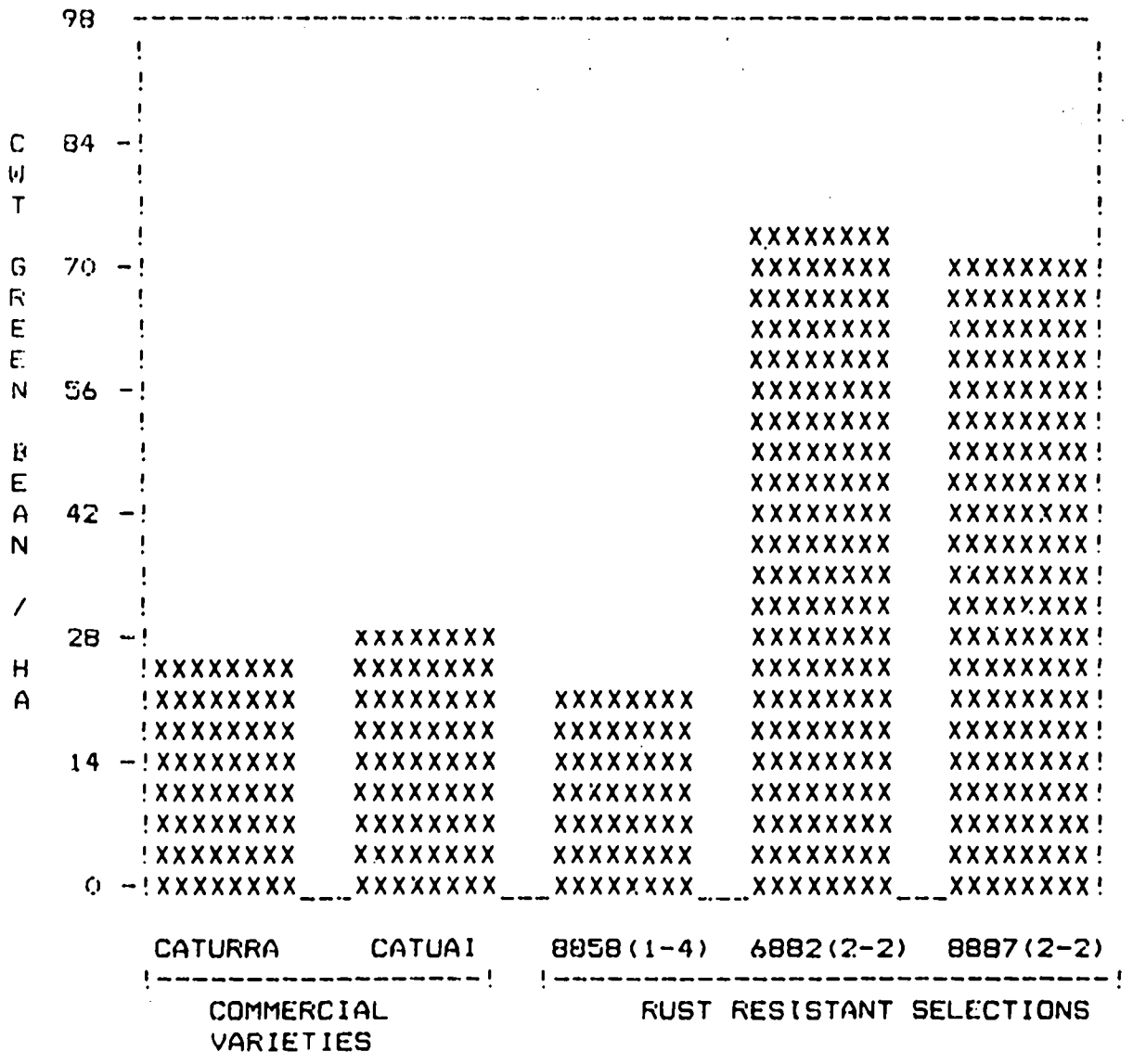
GRAPH 2. YIELD OF CLEAN COFFEE FOR COMERCIAL VARIETIES AND SEVERAL RUST RESISTANT SELECTIONS

(PRODUCTION OF TREES AT TWO YEARS OF AGE)



Through breeding carried out in Costa Rica, Panama, Guatemala, El Salvador and at CATIE, the number of promising crosses between Timor Hybrid or other rust resistant lines and high yielding commercial varieties have been developed that have great agronomic promise. These are planted in national yield test experiments in different regions of each country. In addition, seed or vegetatively propagated plants of the most promising of these crosses have been sent to CIFC in Portugal or the UFV in Brazil to evaluate their rust resistance. To date, CIFC has evaluated 297 selections sent to it for a range or rust races and the UFV has tested 257 selection for race II rust and others, under PROMECAFE agreements with these institutions.

Demand for seed of a broad range of superior yielding and/or resistant crosses (F-6 generation Catimor)has been very heavy both from PROMECAFE member countries and other coffee programs world-wide. PROMECAFE member countries alone have received some 1506 lots of seed shipped since the beginning of the program in 1982 from CATIE.

b. Tissue culture and micro-cuttings

1. Background

During the 1950's, 60's and 70's via M.Sc. student thesis at CATIE, considerable research had been done in the region, on the asexual propagation of coffee by cuttings. The results of this work, amply demonstrated that coffee could be propagated asexually and that the resulting plants grew and produced well. It took a minimum of three months to root a cutting and only 15-25 plants could be reproduced from a single mother

plant annually.
The cost of a plant produced asexually was several times more expensive than seed grown plants. However, at the time, there was a lack of high yielding heterozygus mother plants to warrant this method of propagation.

In Guatemala, Mr. Reyna developed a method of seedling grafting of high yielding C. arabica varieties on C. canephora. Work in India and Guatemala had shown that many lines of C. canephora were nematode resistant.

The Reyna grafting system had been adopted by many medium size coffee producers in Guatemala. Several million two component plants are now in production in that country.

2. Project activities

PROMECAFE has built and equipped a modest but very functional and versatile laboratory for work on all phases at tissue culture. It is linked to greenhouses and shade houses essential to this type of activity.

The CATIE tissue culture program has employed one tissue culture specialist, a laboratory assistant and field labor full time under the project.

A French scientist was provided by IRCC for one year to work on somatic tissue reproduction. However, this work was discontinued when it was felt it would not provide results compatible with the project objectives during the L.O.P. In addition, CATIE provided a senior tissue culture specialist from its staff to manage the construction and equipping of the

facilities at the initiation of the tissue culture program. In 1983, the IRCC of France provided a full-time tissue culture specialist to work on microcuttings as a member of the PROMECAFE research team.
Throughout the evolution of this program activity, students have been brought to the center to study tissue culture and microcutting production methods.

Through the use of project funds, two in-service training, workshops on tissue culture (1985 and 1986) have been held and one M.Sc. Thesis has been completed. In addition, two M.Sc. level students are now preparing thesis level research on specific aspects of tissue culture.

Since the Midterm evaluation, the project team working on tissue culture has made a major breakthrough in the development of microcuttings.

Using excised single node cuttings, an entirely new procedure has been evolved that now permits its use in reproducing superior coffee lines for field testing and commercial production. (See Annex 3)

Bottlenecks in multiplying material, stimulating rooting and the transfer of the microcutting from "in vitro" culture to normal growth of the plant in plastic bags have been solved.

This new procedure is ready for transfer to participating countries for the multiplication of elite lines and individual plants. It is estimated that, on a commercial basis, the technique can be made to compete with seed reproduction on a per unit cost-basis.

3. Observations and conclusions

The plant improvement area of the project has made outstanding progress since 1982. It has greatly improved the technical capacity of national technicians to plant, care for, collect data and analize results of a very broad range of coffee cultivars and new crosses in their countries. As a result, there has been a major change in attitude of national technicians and a greatly improved level of performance throughout the region.

The existence of PROMECAFE, and especially the project, has permitted member countries to gain access to technologies, methodologies, training, networking and a broad range of new rust resistant plant material that would not have been feasible to obtain on a country by country basis. The solid linkage between the Coffee Rust Center in Portugal and the University of Vicosa with the project, has permitted a level of training, testing of rust resistant crosses and technical assistance in PROMECAFE member countries not otherwise possible. It has resulted in a quantum improvement in rust resistance genetic testing and research throughout the area.

This linkage between the member countries and the major rust centers of the world, as it continues to evolve, will permit this region to become a major source of genetically improved new rust resistant types of coffee that can increase the region's stature to the level of Brazil and Colombia, within a few years.

The increased emphasis on the individual plant as the unit of

selection in the region's plant improvement program is a significant step forward. Where, at the project outset, it was believed that these new rust resistant crosses would be sufficiently homozygote (e.q. uniform) to go directly from the testing of individual rust resistant lines to commercial production of new varieties (or lines), it is now realized that this assumption was made with an inadequate understanding of the problem. The use of individual plants as the selection unit and the collection of a broad range of agronomic, qualitative and genetically oriented data on these crosses will now permit the selection of truly superior types for validation and commercial distribution.

The breakthroughs made to date in plant reproduction by microcuttings is another major accomplishment of the project. It is estimated that the system will permit the multiplication of a single parent plant by a factor of ten each two to two and a half months. (See Annex 3)

This means that on selecting an individual plant, an estimated 10,000 progeny can be secured in the first year and several million plants could be ready for field planting within three years. Preliminary calculations on mass propagated progeny, using this methodology, appear to show that it can be carried out at the country level, by CATIE trained national personnel, using very modest physical installations at a price per plant competitive with current seed reproduced plants.

Linking the best high yielding rust resistant plants in the best progeny, with microcutting reproduction can take coffee production in the PROMECAFE countries to a new level of technology not foreseen at the beginning of this project. If

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it is successful as the evaluation team believes it to be, this system could propel the PROMECAFE countries into the forefront of coffee plant improvement worldwide. The use of rust resistant high yielding clones (asexually reproduced outstanding plants) in the region could greatly benefit both small and large producers by increasing per area yields and reduce rust control by chemical application to an absolute minimum.

This new system will eliminate the necessity of making five to seven backcrosses (and concurrent testing at each step for rust resistance) with the usual loss of hybrid vigor that is now used in development of new sexually reproduced varieties.

This process alone would take some twenty to thirty years to accomplish using conventional plant breeding methods to produce a new variety that was homozygote for production, morphological chracteristics and/or quality. The only steps in the new system that needs to be proven is the ability to train and build commercial level installations in one or two countries and prove the economic feasiblility of the system. The evaluation team highly recommends that this be done within the next two years. We propose that the best countries, for this activity, because of the progress they have made in their selection program, would be El Salvador, Honduras and/or Costa Rica.

The identification of superior lines and plants in the oldest trials is only three crop years old. Most of the newer trials, of the best rust resistant crosses, are only one or two crops years old. It will be absolutely essential to have a minimum of four crops and a plant vigor evaluation of the

plants for their fifth crop year, before any meaningful selection is possible. This will mean that the program must continue for another two to three years before the first selections can be confidently identified. At that time, based on the available data today, these selections will have very strong resistance to race II rust and possibly several other races not yet found in this hemisphere as well as superior yield and agronomic characteristics.

The evaluation team has noted several areas in which this program should be improved, if extended. These are:

a. CATIE has none on its staff working on coffee improvement. It's administration is now considering coffee as an area of major focus for the future. If it does, it should be encouraged to employ a top level plant breeder to work in coffee.

b. In the meantime, the project should employ a highly qualified plant breeder to work with national technicians in the analysis of the existing data, determination of new plant architecture for coffee and the verification of superior lines/plants in different ecological situations.

c. A method must be found to reduce the number of plants on which comprehensive data is collected. At the present time, country programs are collecting over 200,000 data per year.

   A method must be found to eliminate data collection on the poor performing plants and lines as soon as possible. This would permit the national programs and

PROMECAFE/CATIE to concentrate on a broader range of potentially promising high yielding rust resistance lines than is now possible.

d. All data is hand tabulated at the country level and a functional data bank, at the regional level does not now exist. The new computerized data program developed by PROMECAFE should be installed in each country as soon as possible. The countries should be encouraged to purchase a computer exclusively for this data base. Copies of all data generated in the countries should be incorporated into a Central Data Bank at CATIE to prevent its loss and permit intercountry evaluation of superior lines.

e. The PIADIC/CIDIA data bank should be brought up to date and again made operational. The lack of this very important system - especially its ability to identify analagous soil and climatic situations in country and throughout the region will permit the program to predict where a new selection may perform best in individual countries and among countries. It also will be extremely valuable as verification trials are designed in the near future to locate them in analagous ecological situation.

5. APPROPRIATE TECHNOLOGY DEVELOPMENT AND TRANSFER

a. Objectives:

At the conception of the project, no member country of PROMECAFE had a well defined or well financed program to serve the small coffee producer. Only USAID Honduras, in parallel with PROMECAFE, was developing a coffee credit and technical

assistance program to serve small holders.

The basic premise of the IICA/ROCAP Program was that if small holders could not sufficiently technify their crop to produce at least two "quintales" more of coffee per "manzana", they would not be able to pay for the added cost of disease prevention and control. Further, that in a few years of total neglect their plantations would soon die. PROMECAFE selected a farming systems approach as a possible methodology to develop appropriate technology for specific sectors of coffee producers. In several countries, together with local coffee technicians, area and farmer profiles were developed that provided site specific data on: natural determinants, technology levels, socio-economic conditions plus marketing and commercialization practices.

These were analyzed and first approximation technology packages were developed for several different user levels.These packages were then tested and validated with farmers in their own coffee plantations.

Area specific characterizations were completed in two countries, Honduras and El Salvador. Technology packages were developed for three levels of small farmers, depending upon their own access to credit and/or inputs, were then validated at the field level. Modifications of the PROMECAFE methodology were used in Guatemala and small farmer technology packages tested and validated there also. The role of PROMECAFE was to develop and refine a system to access technology needs, identify appropriate packages and transfer these to small farmers. It was not necessary to perform this function in every country in order to verify a systems

approach.

b. Achievements:

The hypothesis that small farmers, even without credit, can successfully apply some components of modern coffee production practices and increase yields sufficently to cover the cost of rust or broca control was proven by PROMECAFE to be correct and applicable at the field level. As an approach, it has been now adopted by coffee offices in at least three countries.

As more knowledge is acquired by PROMECAFE in the management and control of rust and broca, the more economically sound the various technology packages should become. Sampling techniques developed by the project and the corresponding spray regimes have already reduced original estimates of spray materials by over one-half. The mass introduction in the near future of rust resistant, high producing coffee varieties, will further increase farmer incomes and lower production costs.

c. Progress and Impact

Small farmers, even those with no credit, using only improved cultural practices and chemical controls have increased their yields from 5 quintales per manzana to over 15.5 quintales in less than three years. In other cases, where new varieties were included along with cultural and disease control measures, yields exceeding 35 qq. per manzana have been recorded. Small farmers receiving credit and using a complete package (as in Honduras, Costa Rica, and Panama) have easily exceeded rates of 50 quintales or more per manzana.

Additional impact of small farmer coffee technification can be measured by other bilateral USAID's programs that are now available and that were not contemplated at the start of the PROMECAFE Program. In both Costa Rica and El Salvador, mission programs are now assisting small holder coffee producers.

Honduras has completed its first small coffee grower loan program to more than 6,000 clients and has recently started on a second phase. Panama has disbursed its entire small farmer loan portfolio and may begin a program to work wilth farmers who have little or no access to credit. Guatemala is now attending through ANACAFE, over 8,000 small farmers who have applied technification to their coffee production and have more than tripled their former yields. Prior to PROMECAFE no services were supplied by ANACAFE to small producers.

d. Problems and Constraints

In a regional program it is not necessary to try a methodology in each country to validate its effectiveness, nor is it necessary nationally to verify all technology packages.Because of many similarities and common constraints in the region, the project was designed to extrapolate both proven methodologies and packages to analogous areas. In part, this has been very successful.

However, the lack of an expected regional data bank or computerized network, building upon the former PIADIC information management system, has critically limited the extrapolation activities in this output. The IICA counterpart input called for by a Conditions Precedent in the Project

Agreement, to provide five PIADIC technicians to backstop this activity during the life of the project, was not met. This lack of IICA commitment has seriously diminished the potential of this technology transfer activity.

e. Conclusions and Recommendations:

The systems approach has been very successful in analyzing production constraints and producing first approximation packages of technology for several levels of users. The ability of PROMECAFE to identify given target groups, including those with no access to credit, and move them into more sophisticated technologies with higher resulting production yields, has proven effective and is being replicated in a majority of the member countries.

1. The team recommends that further efforts should go into perfection of an information management system to manipulate research results and into extrapolation of proven technology packages. Characterization work should continue in member countries where there is a demand and where resources are available.

2. PROMECAFE should assist coffee offices not now attending "non-credit clients" to move into this important technical assistance area, in particular in Panama and in areas outside the pilot zone in Honduras. Donor agencies, such as USAID/Honduras, should not limit their actions to traditional one-on-one supervised credit methods. The PROMECAFE group methodology has much to offer and if applied regionally could increase by many fold the small farmers now being attended.

3. IICA should reconsider the use of the once operative CRIES system installed at its San Jose headquarters and the role of information management in this and other IICA Projects.

6. TRAINING

a. Institutional development:

Training given under the project at all levels has clearly been one of the most successful components of PROMECAFE. Project goals in terms of the number of scientists and technicians have already been exceeded. Numerous instructional guides and teaching materials have also been produced as part of the output of this key activity. A brief outline of the kinds of training and approximate numbers of participants are included below.

b. Third Country Training:

The project agreement called for training at least 12 technicians from Central America and Panama in rust varietal work at CIFC, in Portugal, and at the University of Vicosa, in Brazil. Actually 15 scientists from this region have been trained at these two institutions. In addition, several member country coffee technicians and scientists have been trained in France under the auspice and funding of IRCC.

1. 1983 - CIFC, Oeiras, Portugal

Rolando Vásquez, Costa Rica
Anselmo González, Nicaragua

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University of Vicosa, Brasil
Francisco Anzueto, Guatemala

Montpellier, France (ROCAP support)
Hernán Serrano, Costa Rica

2. 1984 - CIFC, Oeiras, Portugal
Rodney Santacreo, Honduras
Erwin Vásquez, Guatemala

University of Vicosa, Brasil
Humberto Bermúdez, Panamá
José Irigoyen, El Salvador
Humberto Gómez, Costa Rica

3. 1985 - CIFC, Oeiras, Portugal

Fabio Bautista Pérez, El Salvador
Carl Williams, Panamá
Isidro Barboza, Nicaragua

4. University of Vicosa, Brazil
Orlando Mora, Costa Rica
Edwin Flores, Honduras
Guadalupe Rivera, Nicaragua

c. <u>In-service and regional short course:</u>

The project agreement required at least 50 national technicians to be trained and that the program promote at least 15 short courses with durations of up to two weeks

during the life of the project. Quarterly and annual reports, as well as special PROMECAFE training publications, contain very detailed information on course content, publications and participants. To give the reader an overall picture of the actual outputs of this component, a summary is included below, for the years 1982 through 1986.

TRAINING ACTIVITIES COMPLETED BY PROMECAFE

YEAR	NUMBER OF ACTIVITIES	NUMBER OF PARTICIPANTS
1982	12	334
1983	26	1,092
1984	35	1,217
1985	45	1,176
1986	28	730
Totals	146	4,549

At the time of this evaluation, most of the technicians trained overseas were still working at coffee production tasks in national institutions. Only three, out of more than 20 that have received off-shore training, were not directly associated with PROMECAFE activities at the time of this evaluation.

The present five year agreement between IICA and the PROMECAFE member countries terminates at the end of this calendar year. Every member country we visited spoke highly of the in-service training rendered by IICA, not only for their technicians and scientists but also in "training the trainers" activities. Many of these were organized by PROMECAFE in conjunction with local farmer training activities. In the future, IICA/ PROMECAFE certainly will be asked to train nationals in areas

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other that those sponsored under this grant. This, of course, will depend on the priorities established under the new five year IICA/PROMECAFE agreement scheduled to start in January of next year.

PROMECAFE is still seen by national agencies as the major source of training for their technicians. Several other donors have contributed resources to this component, in particular the Government of France.

d. Problems and Constraints:

No major problems were voiced by local coffee offices interviewed. One course on rust epidemiology remains to be given before the PACD date.

Two of the Nicaraguan technicians did not return to their country after overseas instruction.

e. Conclusions and Recommendations:

In visits to each member country, the team was impressed with the in-depth knowledge of coffee problems as expressed by national technicians. They were enthusiastic about their jobs and professional in their technical work. Their ability to strategize present and future investigation or transfer work was unmistakably at a more sophisticated level than before the AID grant. The spin-off from training in terms of institutional development, of a regional coordinating structure and six national coffee offices, scores extremely high.

1. IICA should increase support to PROMECAFE with core resource allocations as well as seeking outside donor assistance. Stronger linkages should be developed between other regional and international agencies working in coffee production. IICA should help the national coffee programs develop funding proposals seeking USAID assistance in research, technology transfer programs and for scholarships.

2. Special funding for thesis work in coffee related problems at CATIE should be made available through ROCAP projects, or from other funding sources.

3. During this last phase of PROMECAFE, more emphasis should be placed in better organizing project training matarials into self-instruction modulars, or guides for national trainers. The work in multi-media presentations, such as those completed in genetic improvement, should be continued.

7. COMPREHENSIVE INFORMATION NETWORK

a. Objectives

The project design envisioned PROMECAFE being assisted with its many information and data management needs by IICA, through its PIADIC information network program, and by CATIE using its Small Farm Production System (SFPS) regional research data and information management systems. A Condition Precedent to project disbursements required IICA to make five PIADIC technicians available during the life of the project

(See SC/DG-3307) to backstop PROMECAFE research and information activities.

Research data was to be recorded and inputed into the IICA regional CRIES data bank as well as new tracking systems established for rust and broca infestations in each country. Photo maps developed by PIADIC were available in most countries delineating all the coffee production zones. Detailed spatial agricultural information, on a kilometer square grid basis, was also available at CATIE and IICA on their CRIES systems. The use of these, then on-going systems, were to enable PROMECAFE to become a major computerized information and data analysis source on coffee production and pest management practices in C. A. and Panama.

b. Achievements:

It was difficult for the evaluation team to find evidence that the considerable information management capabilities of IICA or CATIE were used during the first phase of PROMEACAFE. It appears that even area profile information developed for technology transfer activities had to be processed and analyzed by outside sources. No standardized system seems to be in place for banking agronomic research results or for extrapolation activities.

During this last year data programs have been developed to manage genetic information for PROMECAFE regional variety trials.

IICA and CATIE have collaborated with PROMECAFE by inputting some 7.000 coffee articles into a computerized bibliography

software system. Documents can be retrieved by key words, authors, countries and other broad category indicators. The PIADIC system for geopolitical retrieaval, unfortunately was not employed.

c. Progress and Impact:

At present, since neither the plant improvement or bibliographic information programs are operative on a regionalor national level, the impact of this activity has been nominal. It is expected that both software systems will be available to each member country before the end of the year and training activities are planned for national technicians in their use. Both will be welcome additions to local coffee office operations. The numerical program should assist greatly in the management of many thousands of data that are now collected and analyzed by limited manual systems. The bibliography software should serve as a mechanism for regional and national coffee documentation control and retrieval.

Special instruction has been given by IICA to national personnel working with coffee documentation in each member country. A network of sorts has been established within the region.

Input of agronomic or pest management research results into a regional information system as called for in the Project Paper will not be accomplished by the PACD.

d. Problems and Constraints:

Both CATIE and IICA were well endowed at the inception of

PROMECAFE with equipment and trained staff to have moved the coffee project into an efficient information management mode. It appears that lack of dedication or understanding on the part of IICA or CATIE administration of the serious need for PROMECAFE data base development and analytical capabilities clearly impeded progress in this activity. The failure to supply the needed PIADIC backstopping capabilities during the LOP, further hindered the creation of adequate research information systems and failed to supply needed economic parameters for much of the technology development and transfer work carried on thus far in the project.
IICA and CATIE, not PROMECAFE, failed to complete the required informatic tasks in this output. Two subsystems for very specific uses will be developed and institutionalized as part of the PROMECAFE project. However, an improved PIADIC regional data base enriched with coffee research results will not have taken place during the life of the project (LOP).

e. Conclusions and Recommendations:

1. The team recommends that the two software programs of documentation control and plant breeding be released to the countries, as soon as possible.

2. IICA and ROCAP should reflect on the millions spent on the PIADIC regional information system and what this would have contributed, if maintained and enriched, to the present project and to IICA in general. If IICA is not the correct agency to manage such a system then perhaps CATIE should be assisted in making operative this much needed regional endeavor.

8. EXTENSION AND TECHNOLOGY TRANSFER METHODOLOGY

a. Objectives

In section 5 above, PROMECAFE methodology for the development of appropriate technology packages for small farmers was discussed. Basically, a Farming Systems approach was used to determine the present status of small producer coffee operations and how these might be improved through technification.

An exciting spin-off of this activity, and thus treated separately here, was of an extension technique of working with farmer group as a project vehicle for technology transfer and income improvement.

Since its inception in 1978, PROMECAFE has acted as a service organization to its member countries. Yearly budgets and plans of work are developed by the Board of Directors. Monitoring and evaluation efforts are controlled by local coffee offices. As a part of the IICA/ROCAP project, special attention was called to the plight of the small coffee producers in Central America and Panama. Some 205,000 grow this crop throughout the region and must become an integral part of any program that pretends to control rust or broca.

Extension methods formerly used in most of the region had been designed on a supervised credit basis with individual visits to each farmer. Considering the vast numbers of farmers that had to be reached with coffee pest information and improved coffee production techniques, PROMECAFE and ANACAFE initiated a group program "Grupos de Amistad y Trabajo", (GAT) on a

trial basis, working mainly with farmers who did not have access to credit and in many cases, could not read or speak Spanish. GAT later became the key extension technique for the project.

As mentioned in the Project Paper, at the start of the program there was little cause for optimism that national systems could provide the services necessary to modernize the 180,000 manzanas set as a five year regional target by member countries. Local resource allocations for credit are still major constraints to needed production inputs and technical assistance. What has changed drastically during the last six years is the quality of technicians now working with coffee improvement and production programs. A better understanding has developed on rust and broca control programs in the regionand this is being transmitted to many small producers. A consolidation of different agencies, working on coffee problems in each country would seem in order. It would reduce duplication of efforts and allocate scarce resources closer to the eventual client, the coffee farmer.

Integration within the project of research and extension staffs was achieved by insisting that investigation and technology are a single continuum. By using a systems approach, site specific technology packages or farmer options developed, were the joint efforts of both extension and research personnel. This factor has been crucial in the success of moving these improved technologies to even the most

resource shy of farmers.

b. Achievements

The GAT program, first started in Guatemala, has proven to be very successful as an extension mechanism for transferring site specific technology, developed by PROMECAFE and national scientists, to small farmers. The methodology is now being applied in Honduras and El Salvador. Data was not collected on Nicaragua. Panama must, in the opinion of the evaluation team, move into this mode quite soon as rust has become established there. The present one-on-one farm visit system will not be sufficient to meet this new challenge. Costa Rican extension efforts have followed more traditional lines.

c. Progress and Impact

Progress has been more than satisfactory and impact can be easily measured. Extension agents are individually giving quality service to as many as 12 different groups that consist of upto 25 farmers each. Some 8,000 resource poor farmers are now being assisted in Guatemala alone, through this mechanism.

Using on farm demonstration and teaching techniques the agent is able to meet monthly with each group and make at least one farm visit to each member during the year. The review team was very impressed with the data and records kept by each agent on the number of technified plots their group had implemented. We were equally impressed by the spin-off or "ripple effect" that is taking place in the different group locations. Many of these technified plots are being established by non group members and were very good examples

of a positive multiplier effect.

Yields on farmer plots were very impressive with (200-300%) increase over the previous harvest, after only three seasons.

d. Problems and Constraints

The collaborative research and extension activities that were to have taken place in Honduras between ROCAP and USAID/H coffee projects did not materialize. PROMECAFE is presently collaborating there with IHCAFE in a pilot group program. PROMECAFE philosophy is that it is difficult for an extension agent to be both a transmitter of technology and a collector of farmer loans. The pilot program, consisting of an extension agent providing technical services and training and a credit agent to collect loan payments, has proven very effective and should be institutionalized throughout Honduras.

e. Conclusions and Recommendations

PROMECAFE has shown their member countries that there is an effective mechanism to treat large number of resource poor farmers and move these clients rather quickly into quite technified production schemes. Increases in yields are testaments to the quality of technology packages that are being developed and evidence that farmers will invest their money and time in crop protection programs.

1. The team recommends that the group methodology be continued and that other media channels be investigated to supplement and reinforce this activity. In several countries radio or television has been used but

limitation of local funds remains a constraint to its extensive use. Private sector assistance might be an appropriate sponsor for these mass media messages.

2. A normal process, when working with groups, is for them to move or grow into other developmental activities. There are indications of this phenomenon taking place in several of the PROMECAFE supported groups. While agreeing that this is a positive sign of maturity and group adhesiveness, the team feels that coffee extension agents should concentrate on coffee production technology development and transfer activities and not convert themselves into general rural development agents. We find this possibility as potentially dangerous as change agents acting as collection personnel for credit programs. A strong catalytic role for coffee extension agents should be as far as PROMECAFE methodology should go.

3. Future ROCAP efforts with PROMECAFE should keep in mind that technology transfer is but one set of tasks on a continuum and that research, on the other hand, must also be assisted and improved. It would be improper to concentrate only on extension efforts and not fill the several improtant PROMECAFE investigation gaps still needing attention.

E. Sociological Dimensions of Project Activities

1. PROMECAFE and National Coffee Offices

IICA, the administrative organization for PROMECAFE, has had

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several decades of experience working in the Central American Region. An IICA Director is located in each PROMECAFE member country and assists in the coordination and liasion linkages between that local government, national coffee organizations and IICA/ROCAP project personnel. Social dimensions and priorities at the operational level for all IICA country programs are interpreted and implemented through this person in accordance with IICA general policy.

Success in the implementation of any regional program depends upon the collaboration and input of the national organization designated as the working counterpart. PROMECAFE has had excellent rapport with the local agencies and through them to national coffee technicians and farmer groups. Special emphasis was taken to use a systems approach that would offer some type of improved technology to every interested farmer. None were to be excluded because of lack of credit or other inputs. This unique approach has been judged by the national coffee technicians and their farmer clients as quite successful.

2. Beneficiaries

Three major gropus have benefited from this project. First, the national technicians trained under PROMECAFE auspices and the agencies they represent. A much higher level of understanding about coffee production problems and their resolutions exists now than before the project. The second major beneficiaries are the small and medium farmers that have been the project target groups for technology development and transfer activities. Lastly, are the migrant workers hired on all sizes of coffee plantations. Increased technification,

regardless of farm size, requires more labor input. Consequently, this group has benefited through a ripple effect during the last six years.

3. Role of Women

It is difficult to attribute direct project support to this third specific group. An estimated 10% of the farmers receiving technical assistance by local coffee offices are women. In terms of PROMECAFE activities, women play an important role in several of the local investigation teams and have fully participated in all training activities. Few extension programs visited employ women agents. However, several are discussing the need to establish a home economic activity as part of their service program.

4. Problems and Constraints

Project resources were designed and allocated towards efforts that dealt with small farmers. Larger allocations of local resources were anticipated. These seem not to have been made available, but would have been very beneficial in reaching more of the target group. Efforts were possibly hindered in Honduras and Panama where technical services of large loan programs were limited to national credit recipient without considering the PROMECAFE model.

5. Conclusions and Recommendations

AID policy in terms of assisting the less endowed, employment generation and institutional building seem to have been more than met in this project.

Several of the team members felt that female extension agents should be employed by local coffee organizations.

F. Technical Assistance

1. Long Term Project Staff

The project long-term staff include the following people by funding source and length of service in the PROMECAFE program.

Funding Source	Person	Time Frame	Position
IICA	Carlos Enrique Fernández	April 15, 1981 March 31, 1983 Jan. 1, 1986 to date	Project Leader
	Aníbal Palencia	April 1, 1983 Dec. 31, 1986	Project Leader
	Paul Bornemisza	Nov. 15, 1982 August 14, 1984	Project Administrator
	Germán Molina	August 1984 July 1985	Project Administrator
	Carlos Arauz Flores	August 1985 to date	Project Administrator
PROMECAFE	Eduardo Andrade	April 15, 1981 to date	Extension and Communications
	Jorge Hernán Echeverri	April 15, 1981 to date	Plant Pathologist
IRCC	Marc Berthouly	April 15, 1981 to date	Tissue Culture Specialist

	Bernard Decazy	April 22, 1985 to date	Entomologist
CATIE	Ludwig Muller (50%)	April 15, 1981	Plant Specialist
IICA SUPPORT	Edgar Ibarra	N/A	Statistician
	Alfredo Alvear (CIDIA)	N/A	Librarian
	María José Galrao	N/A	Librarian
	Ana María Arias	N/A	Librarian
	Pedro Oñoro	N/A	Statistician
	Juan Antonio Aguirre (CEPI)	N/A	Economist
	Rodolfo Teruel	N/A	Economist
	Jorge Caro	N/A	Economist
OIRSA	Braulio Vidal	N/A	Technican

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Zía Javed (El Salvador)	Jan. 23, 1983 March 15, 1987	Plant Pathologist
Norberto Urbina (Guatemala)	Feb. 4, 1985 To date	Entomologist
Gilberto Vejarano (Honduras)	Jul. 20, 1983 To date	Communications Specialist
Freddy Alonzo (Guatemala)	Oct. 1, 1982 Oct. 17, 1983	Entomologist
Oscar Rojas	Jan. 1, 1985	Specialist in Agroclimatology
Nidia Morera	Feb. 17, 1986	Agronomist
Humberto Gómez	April 15, 1982 Feb. 15, 1986	Agronomist

Alberto Barrios	Oct.	15, 1986	Agronomist
Luis F. Avendaño	Jun.	1, 1984	Agricultural Technician
Eddy Mora	Jan.	1, 1986	Agronomist
Alfredo Rivera (El Salv)	May	1, 1985	Assistant in Rust Control
Marielos Solano	Sept.	22, 1982	Laboratory Assistant
Juan Luis Ortiz	Jan.	9, 1984	Technician
Guillermo Hidalgo	Jan.	1, 1986	Computer Assistant

2. Short Term Technical Assistance

The project short-term staff has included the following people:

1982	Roberto Pérez	Architect	Construction of Processing Plant
1982	JABettancourt	Pathologist	Rust and Genetic Resistance
1983	JABettancourt	Pathologist	Rust and Genetic Resistance
1983	Pierre Dublin	Genetist	Tissue culture
1983	JABettancourt	Pathologist	Rust and Genetic Resistance
1983	Humberto Gómez	Agronomist	Plant Breeding
1984	Jorge Castillo V.	Communications SP.	Information Centers
1984	Freddy Alonzo	Entomologist	Broca Literature
1984	Joseph G. Cummings	Chemist	Chem. Residues
1984	Jaime Castillo	Pathologist	Coffee Selection
1984	Víctor Vásquez	Communications SP.	Area Profiles
1985	Olga Ma. Cabezas	Librarian	Information Network
1985	Orlando Martínez	Librarian	Literature Review
1986	Oscar Rojas	Agroclimatologist	Coffee Zoning
1986	George Op den Bosch	Engineer	Coffee Processing Plant

3. General Observations

The administrative mode of IICA for international professionals offers all of the amenities and benefits that are thought to be the norm in overseas development work. The country agreements developed between IICA and host governments make it quite easy for a donor to use IICA as a mechansism for project implementation. Field work in PROMECAFE, to establishlong-term international technicians or in providing logistical support to short-term consultants, met with a minimum of problems.

The day to day management aspects of this project were enhanced, the team feels, because both team leaders were scientists in their own right and had many years of experience working with coffee or farming systems research projects. This allowed a much better understanding, by management, of staff problems being encountered and resulted in a quicker technically sound response time.

Staff moral was high at the time of the evaluation and enthusiasm to get-on with the project was evident at all levels. Project management seems to have been based largely on mutual trust and an appreciation of the skills possessed by each team member. Field staff appreciated the quarterly meetings held through 1986 and felt this was singularly their best opportunity to gain more knowledge of each team members activities and developed a PROMECAFE methodology that could be replicated in member country.

No country singled-out any member of the staff for criticism.

The broca work seems to have suffered the most from lack of attention by both OIRSA and the first IICA technician stationed with PROMECAFE. Suggestions by the country members were that project staff should be housed in the coffee offices and not with IICA. It was felt this would lead to better collaboration and coordination of research and extension activities.

Several gaps in providing timely scientific input to the project have taken place. The long term plant breeder position was not filled, due to a prolonged IICA nomination process. An alternative plan was approved by ROCAP to provide this input through a series of short term visits by Dr. Bettancourt, of OEIRAS, Portugal.

Work on the broca component was in limbo from late 1983 until early 1985, for lack of a project entomologist.

Lack of knowledge or scientific skills were not problems encountered in this project. Technicians hired by IICA were knowledgeable in their own specialities and in coffee production. With the exception of the first Team Leader, other PROMECAFE technicians were not asked to work outside their technical field of specialization or to support activities not directly associated with coffee production and/or pest management.

It does not appear that the four half-time coordinators that IICA was to place at the country level were appointed nor was there much input from the five PIADIC technicians that were to backstop PROMECAFE during the LOP.

Active participation of other tenured staff from the three regional institutions signatories of the project were at a minimum. CATIE placed a tissue culture specialist on a half-time basis and OIRSA did provide limited advisory assistance, but not at the agreed upon levels. IICA has supported various training events with regular staff member participation. The French IRCC has performed an outstanding advisory and support role throughout the project. Without their technical and financial support, much of the research and training tasks in coffee bean borer and tissue culture would not have been completed before the PACD.

IICA authorities report that if no donor assistance is located after the PACD, the staffing pattern will be minimal, only that which can be supported under PROMECAFE quota payments and perhaps a team leader from IICA. Little research or technology transfer activities are expected to take place and the main events would be regional or in-country training courses.

4. Problems and Constraints

The normal IICA selection processes seem to have been too long and was a constraint in employing certain candidates. the lack of committed IICA counterpart staff resulted in the project having to purchase these services from other sources. This was certainly the case in the regional coffee pest information system. Unfortunately, there still is not much to show for this outside technical advising effort. No major problems were encountered in IICA financial management of USAID project funds. No project documentation could be found where ROCAP agreed to changes in the roles of CATIE, OIRSA, or

counterpart inputs of PIADIC or the four half-time country coordinators.

5. Conclusions and Recommendations

Although the composition of the final research and extension teams were different than envisioned in the project paper or the agreement, the combination seems to have worked well and produced most of the desired outputs. The project has also been an excellent catalytic agent to draw in other donors, in particular the IRCC technical advisors and long term French training assistance.

1. The team recommends that IICA management fully explain the present project extension, until December of this year, to their field staff and national counterpart agencies as soon as possible. Many technicians do not realize that the ROCAP support is continuing at this time. If the project is renewed, all should know this, or project operation can suffer.

2. PROMECAFE management should reconsider the location of its technicians and the adviseability of placing them in the national coffee associations offices and not in IICA quarters.

3. ROCAP is encouraged, if they are unable to fund this program for the next three years, to secure bridge financing from bilateral missions to cover the critical research gaps yet to be completed at the country level.

IV. PROJECT MANAGEMENT AND IMPLEMENTATION

A. IICA Management as the Lead Institution

1. Team Leader

a. Role, Performance

Two different team leaders have provided project leadership during the past six years. Both have provided very excellent scientific input as well as performing regional and country administrative and management functions. Each had to exceed their original scopes of work and assume a much greater technical responsibility than first anticipated. The original design called for CATIE and OIRSA to lead in the biological investigation work to be undertaken by the project and IICA was only to administrate and coordinate these activities. During the course of the first year it became quite apparent that neither of the two lead research institution had the resources available to complete these tasks. It was then by default that the PROMECAFE team leaders took on a much more complicated set of responsibilities than planned.

To the credit of the leaders' management, problems of a large regional program within an organization as complex as IICA and dealing with an international donor such as ROCAP, have been minimal.

b. Juxtaposition and interaction with PROMECAFE work.

The location of the team leader and time allocations

given to the project have been items of discussion between IICA and the donor on several occasions. San Jose still appears to be the best location in juxtaposition to CATIE. Technicians at the field level felt that the quarterly meetings held through early 1986 were quite important in building a multi-disciplinary team and common methodology. They also expressed to the review team that more quality time of the team leader needs to be given on this year's program phase if tasks are to be completed and an orderly transfer of responsibilities made to national counterparts.

2. IICA Support

The project agreement called for several Conditions Precedent to be met. Outstanding among these were five support persons from PIADIC and four half-time country coordinators, all were to be provided through IICA core budget accounts. These conditions seem to have been met at the beginning of the project and almost wholly forgotten after a few years of project implementation.

A key element in PROMECAFE was to be the active participation of PIADIC personnel in the implementation and development of a regional information system and in area profile and technology development at the country level. Nothing was accomplished in terms of a regional data base and tracking programs to be incorporated into the CRIES system nor was data analyzed by IICA for the area profile work being done at the country level. The technical assistance in developing economic parameters for technology packages was not forthcoming from this group as was expected. Sufficient project resources were allocated to the PIADIC information management component to

provide PROMECAFE with a solid data base and analytical capability.

It would appear that IICA did not meet its commitment in terms of counterpart resource allocations. It was reported that several PIADIC technicians, as well as the former Team Leader, were dropped from the IICA roles due to budgetary constraints. This is of course a ROCAP/IICA issue and not one that can be solved by this team.

As with all AID projects, procurement was not as rapid as the scientists and technicians would have liked. Overall, and in consideration of the uncertainty of several local coffee organizations, procurement practices have not been a major constraint. Types of equipment, transport, or the appropriateness of the greenhouse were areas of concern that local technicians and PROMECAFE staff discussed most frequently with the evaluation team.

The final composition of the research team differed from the original proposal in that candidates for several positions were unavailable or unwilling to wait for the prolonged IICA process for nomination. Nevertheless, the team was impressed with the caliber of the scientific and technical staff provided by and to, the project. The considerable success the project has had in methodological development and scientific results is clear testimony to PROMECAFE staff selection.

3. Sub Contractor Performance

a. CATIE was to be a key research element in genetic improvement and technology development activities. It became apparent

early-on, that this could not happen and the leadership for this area reverted to PROMECAFE staff. CATIE did contribute the land, infrastructure development and logistical support as required in the Project Agreement valued at approximately US$300,000.

b. OIRSA was originally designated as leader of the biological and residual studies to be conducted on both rust and broca problems. Financial problems forced OIRSA to withdraw from these three project components and PROMECAFE staff undertook these added responsibilities. OIRSA was able to contribute some logistical and technical assistance in Guatemala.

4. Problems and Constraints

Considering the dynamic evolution of the project, with an ever shifting role of more responsiblity into PROMECAFE and away from the two lead research agencies of CATIE and OIRSA, management problems have been minimal.

The rather tortuous IICA nomination process did cost the project several world class scientists who could not wait the many months of this exercise. The changing philosophies and priorities of IICA were also constraints discussed with the review team. The IICA country directors were less than helpful to project staff on many occasions. The reduction of IICA resources devoted to the project, significantly reduced counterpart staff input during the last few years of the program.

The evaluators found it hard to believe that CATIE has no scientific staff assigned to coffee production even though it is the single most important crop in Central America. The national

coffee offices were also quite critical of the CATIE commercial coffee operation and felt it was not at a standard commensurate with an international research center expected to be on the leading edge of agricultural technology.

Even though OIRSA did not have the financial or human resources available to undertake the biological research tasks, the review team felt OIRSA could have done more on regional legal and standardization issues.

During this final evaluation, the review team found only one country, El Salvador, where a USAID ADO had visited the project site. The team feels that AID resource allocations should come from bilateral missions, not ROCAP, for credit to small farmers. Based upon El Salvador's experience, IICA and the ROCAP project management should make every effort to see that the ADO from each country visits several investigation and transfer sites and understands the progress and value of this program before the PACD.

5. Conclusions and Recommendations

Under less that ideal conditions, IICA and the PROMECAFE staff did an excellent job of project management, administration and implementation. It was not clear to the team, if ROCAP were to finance a second phase, whether the project should be managed by CATIE or IICA. Certainly the biological components fit better under CATIE than they would under the "New IICA". The important factor will be the treatment of the PROMECAFE network concept by IICA, with or without donor assistance, and what core resources support will be built into this program extension.

1. The review team recommends that ROCAP continue support of the

PROMECAFE concept, in the strongest terms and urges IICA to develop a faster means of staffing and get on-line specially funded donor programs for the credit and outreach component for small farmers.

2. We would encourage CATIE to support coffee research with fulltime staff members and bring their commercial production into line with the best farms in Costa Rica.

3. OIRSA says they are still very interested in the rust and broca issues and the team encourages them to become more dynamic in the field of pesticide residues, tolerances, chemical registry, and standardization.

B. ROCAP Project Management

ROCAP has had three Agricultural Development Officers responsible for this project since its inception, assisted by an extremely competent management assistant that now fully manages this activity. She has, throughout the life of the project, maintained very good working relations with IICA and CATIE and has visited project activities in the member countries regularly. The evaluation team has noted that interpersonal relations between the ROCAP staff and the regional project managerial/advisory group at IICA is very good.

Unfortunately, the evaluation team could not verify that the ROCAP ADO's have maintained the same level of relationship. None of the national teams could verify that they have been visited by ROCAP's Regional ADO's in the last several years. Nor could we ascertain that a similar level of contact, discussions and information flow on the projects activities exists between the ROCAP ADO's and their

counterparts working at the bilateral level. In at least one situation, had there been greater liaison, greater financial support for the program, at the bilateral level, could have been assured.

In operational terms, the project appears to be very satisfactory. There have been several complaints that the AID regulations and ROCAP's decision-making process could be further streamlined to better respond to unscheduled opportunities for actions, participation at extra regional meetings and accelerated payment for project expenses.
The evaluation team noted several changes in the operation of the project which appear to be approved by ROCAP. No formal documentation appears in the memoranda of understanding to substantiate this.

1. The CP's include a commitment that IICA maintain a portion of its initial PIADIC staff to serve as the central data bank for the project. After meeting the initial CP, IICA over several years, withdrew this staff for other assignments. There is no capacity in IICA to carry out their function at present. The loss of the data bank is extremely unfortunate at this time. The data available in that bank could now provide essential information for the identification of analagous areas in which the new high yielding rust resistant selections could be employed regionwide and would have greatly improved the information transfer impact of the project.

2. OIRSA was to assume responsibility for residue analysis, registry and analysis of fungicides and insecticides and provide technical assistance in this area. Because of lack of funding and limitations in its staff, it could not fulfill

this commitment. ROCAP permitted PROMECAFE to use other regional institutions, principally ICAITI to perform this work but the role of OIRSA was not changed in the project documentation.

The evaluation team has not reviewed the project's financial operations in-depth. It appears, however, from review of the personal services, equipment and facilities purchased under the project that there has been very prudent and effective use of the available resources.

All of the equipment and facilities appear to be essential, well used and effectively maintained. The only major exception to this has been the laboratory equipment and training of two Salvadoreans in residue analysis. For whatever reason, they could not carry out the analysis of samples as agreed. Possibly, the equipment purchased for them should be transferred to another institution if ROCAP cannot assure itself that they can, in the near future, meet this commitment.

C. Infrastructure Construction and Development

1. Tissue Culture Laboratory

The project constructed the Pierre Sylvain Tissue Culture Laboratory at CATIE, which serves as the headquarters for the laboratory and the offices for coffee plant improvement.

It was constructed by DYCON, S.A. at a total cost of approximately US$50,000.00 and was inaugurated on August 2, 1983.

2. Coffee Processing Plant

The pilot coffee processing plant was developed in two phases. The first step was the construction of the small sample processing plant built by VILACI LTD., MACOPA S.A., Mata and González Ltd. and Cañas and Sequeira Co. The second phase consisted in the construction and equipping of the large scale processing plant.

In 1984, the construction and equipping of the small sample processing plant was completed. Its total cost was approximately US$67,000.00.

In 1986 the physical plant for the large scale plant was completed at a cost of about US$40,000.00. The equipment for this plant was purchased and installed by Ing. George Op den Bosch at a total cost of approximately US$32,000.00.

On February 3, 1987 the large scale processing plant was completed and inaugurated. Only the tests of the plants operational capacity remains to be completed.

3. Greenhouses

At the beginning of 1983, three prefabricated greenhouse units were purchased and shipped to CATIE, El Salvador and Guatemala. They were purchased from the National Greenhouse Company at a delivered cost of US$110,552.00.

One greenhouse was erected at the beginning of 1984 near the tissue culture laboratory at CATIE in Turrialba, Costa Rica.

It was installed on a foundation paid for by the project.

The ARCO Engineering Company constructed the second greenhouse at the ISIC Center at Santa Tecla, El Salvador. Its construction was completed during the month of April 1985.

The third grenhouse was installed on ANACAFE's Buena Vista Farm at Retalhuleu, Guatemala. It was built by Eng. Federico Guillermo Morales López's Company. This greenhouse was inaugurated in July 1986 and was named Dr. "Carlos Enrique Fernández", in recognition of his work for the region's coffee industry.

4. Innoculation Chamber

In order to carry out more advanced studies on rust resistance, in 1986 an innoculation chamber was built. This room is located at the back of the "Pierre Sylvain" Tissue Culture Laboratory at a cost of about US$3,500.00. CATIE provided the labour and materials for this project.

5. Equipment

a. Vehicles

Four vehicles and a motorcycle were purchased for the project. The Pickup (1 ton capacity) and the motorcycle were assigned to the CATIE Center. Three jeeps were assigned, one to Guatemala, another to El Salvador and the third to Honduras. The total cost of these vehicles was approximately US$48,000.00.

b. Equipment

In 1983 and 1984, meteorological equipment was purchased at a cost of about US$30,000.00 to carry out studies on the epidemiology of rust and population dynamics of the coffee berry borer in Guatemala, El Salvador, Honduras and Nicaragua. They are now in use in these countries.

c. Laboratory Equipment

1) In 1983, equipment valued at US$34,000.00 was purchased and is being used by ISIC, El Salvador in coffee rust studies.

2) Between 1982 and 1986 about US$150,000.00 has been used to purchase laboratory equipment for tissue culture, for the greenhouse and pilot processing plant located at CATIE.

3) The cost of equipment purchased for the broca laboratory of ANACAFE in Guatemala was US$22,000.00. This equipment was purchased in 1983 and is now at the Buena Vista Experiment Station at Retalhuleu.

4) In order to support the analysis of residues in coffee beans carried out by ISIC in 1985, the project purchased laboratory equipment valued at US$5,000.00. Among the equipment purchased is a LAMBOLA spectrophotometer.

5) In order to carry out studies on rust resistance and other diseases in Guatemala, Honduras, El Salvador,

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Nicaragua and Costa Rica in 1986, laboratory equipment valued at US$15,000.00 was purchased. This equipment is installed in the six laboratories now operational in the region.

6) The equipment required for studies of broca control in El Salvador and Guatemala were purchased in 1986 at a cost of approximately US$6,000.00.

d. Furniture and office equipment

It was necessary to purchase furniture and office equipment for the various project offices. The investment for this purpose was approximately US$10,000.00. Included in this equipment was one typewriter and a copier being used at CATIE.

e. Audiovisual equipment to support the information transfer portion of the project valued at US$10,000.00 has been purchased.

No major problems were encountered in the construction and development of the facilities. Nevertheless, it has been observed that in some countries, benefitted by the project, the enthusiasm of the technicians appears below desired levels because of their national operational budget limitations. In the case of the pilot large scale processing plant, there was some resistance at CATIE to its construction until it was shown to be cost effective.

In the greenhouses, a major problem has been encountered in their use in Guatemala and El Salvador due to their

inability to control the temperature adequately for the research planned. It would be very valuable to have the technical assistance required to solve this problem and permit the desired level of operation of these important facilities as soon as possible. The purchase of the greenhouses was a sound investment for the project and will permit the country teams to carry out valuable present and future research.

Both the construction and the equipment purchased for the project, provide a solid base for the research program of PROMECAFE. It also expands the research facilities of the research institutes in the participating countries.

D. SUPPORT TO THE NATIONAL COFFEE OFFICES

1. In the opinion of the Head of PROMECAFE, there is strong support for PROMECAFE by the Coffee Offices in the participating countries. This has been verified in the annual meetings by its Advisory Council, which is made up of one representative from each Ministry of Agriculture and one from each respective coffee office. In the case of Nicaragua, their representation in the Council is limited to two delegates from the Ministry. At this time, there is no coffee office in that country. The Consultative Committee of PROMECAFE annually approves the activities report, the financial report and the program budget.

2. There does not appear to be any problems on the financial aspects of PROMECAFE's program. This is due, in part, to the fact that the project is managed by the IICA Central

Area Office in Costa Rica and its accounts are managed separately from IICA's general budget.

The project's income is derived from donations (AID-ROCAP for example), the quotas paid by the member countries, support received from its operational budget and administrative costs derived from project overheads. This provides a comparative advantage to PROMECAFE in comparison with other IICA projects which do not have the same flexibility in their income or management. The income of PROMECAFE also does not become comingled with IICA funds which further facilitates its operations.

3. The payment of quotas has had problems since El Salvador is not up to date in its payments and Costa Rica has not paid any of its quota debt. Costa Rica has indicated that it now wants to become current in quota payments. El Salvador is trying to bring its contribution up to date also. It paid a portion last year and is ready to make another payment.

The form of payment in the respective currencies of each country, has been a serious limitation. The devaluation of currencies, caused by the economic situation of the region and their effect on the exchange rate relative to the dollar, has affected project operations. This situation is a consequence of the way in which the original agreement was created and the payment of quotas was determined. This situation has been ameliorated, in part, by requesting the participating organizations to pay their annual quota at the highest official exchange rate at the time of payment. Nevertheless, it is

estimated that overall quota payments (without considering the Costa Rica situation), is about 70% of the programmed level. This is considered very good when compared with that of other IICA projects in the region.

4. The national research policies of the countries have been incompatible with the program methodologies of PROMECAFE in the region. The initial resistance of the country team to changes in their traditional research procedures (especially El Salvador and Mexico) have decreased as they have seen the good results of the PROMECAFE approach to problem solving.

E. RECOMMENDATIONS

1. PROMECAFE has arrived at a level of maturity that fosters stability and increasing effectiveness in the member countries. Nevertheless, it is important that it continue to improve its operations and image in these countries. This is especially important among the national program directors, so that its work will be productive and expand its area of influence.

2. It is also recommended that the Director of the PROMECAFE program become more active in encouraging countries to pay their quotas so that the financial situation of the overall program remains healthy.

3. It would be very useful for IICA, as well as AID-ROCAP, to find ways of further eliminating administrative bottlenecks. This is especially important for AID-ROCAP. Frequently repayments are delayed which, as

is natural, reduces the effectiveness of the program.

V. LESSONS LEARNED

PROMECAFE has been a highly successful project, perhaps one of the best of this decade. As a multi-country networking research and extension program, with very specific performance tasks, this project offers USAID a unique opportunity to review its project planning, implementation and monitoring procedures. For IICA, the grantee and implementation agent, the past six years should have provided an excellent feed-back mechanism to measure its capabilities in administrative management and coordination modes. For member countries, the networking experience should be a valid case to measure the benefits of a regional system which requires quotas as a means of obtaining additional donor support and resource allocations for national coffee improvement programs. The review team feels that there are four areas of PROMECAFE which have provided special learning opportunities that warrant a brief review.

1. Project Management

Both IICA and ROCAP have permitted a rather flexible management style to prevail within the parameters of this regional project. A major factor in this administrative mode was the changing roles of CATIE and OIRSA from lead research organizations to interested observers with IICA project management, perhaps by default, taking up these added responsibilities. The ability or freedom of the project to adapt to these and other changing socioeconomic conditions in the region was felt by the review team to be very positive. It is clear that with a multi signatory, quota paying, regional networking project, flexibility during implementation must be shown by all parties. This is especially true of research projects. Regional programs must allow for special interpretations

of the rather tight rules and regulations of both donor and grantee.

Grantee counterpart obligations is not a new subject to IICA or ROCAP. The lack of PIADIC input, although a CP in the project agreement, may severely limit outputs in several components and seem to call for some other legal type of agreement between the donor and IICA to avoid this type of issue emerging again.

2. Technology

PROMECAFE was designed to solve several production problems related to coffee rust and broca. Once resolved, these findings were to be transmitted to small coffee producers for introduction into their farming system. The project has been very successful in a number of scientific findings and in transferring these to coffee producers. Through careful investigation of the rust life cycle in El Salvador and other Central American countries, it has been possible to considerably reduce the number of spray applications and at least one-half the amount of chemical materials previously recommended. The benefits of this knowledge have made controlling rust possible in locations where water is a constraint, have lowered projected production costs and will lead to much less environmental contamination . Sampling techniques, now under study in the project for broca, promise as exciting results as those obtained for rust to date.

Work in rust resistant varieties has added much new information to the world's coffee industry. Two major breakthroughs have been made during the last five years of the project. Identification of genetically superior rust resistant plants and the perfection of microcutting techniques. Project methodology in each member country, now measures individual plants within a given family or

variety for yield and resistant traits. Production rates differ greatly between members of the same progeny and much more emphasis must now be taken in selection of individual top yielding "mother plants". This holds great promise for the region in terms of adapted genetic material as does its mass dissemination to small farmers through microcuttings. As with investigation of sampling methodology still under way in rust and broca, this research work on varieties and microcuttings must not be terminated at the end of the project.

Sampling methodologies for residues have been started during the project, there are still many unknowns and much remians to be completed in this area. Leadership expected from OIRSA has not materialized nor have the linkages sought with EPA and other regulation agencies in the United States. Future efforts must address this issue.

Technology packages were developed using a systems approach and an efficient small farmer transfer mechanism validated during the project. Production increases obtained were above those set as project goals. Both activities deserve further assistance after the PACD.

3. Networking

When properly implemented, a networking project should provide for free interchange or exchange of information and materials between those that possess them to those who are in need of them. PROMECAFE has worked very hard to make this process happen. Instructional activities were designed to achieve a maximum of student interchange and exposure to international knowledge sources. Technicians throughout the region have made these

informal linkages and are using these new contacts regularly. Information flow between different member countries is a fact, as is the exchange of rust resistant genetic material between CATIE/PROMECAFE and national coffee offices.

Quota payments are still a problem, as are better working relationships between different USAID sponsored coffee programs in the region. These are management issues and deserve more attention by ROCAP and IICA.

Coffee offices also feel there should be more effort made by PROMECAFE in network and linkage activities within each country.

VI. ACKNOWLEDGEMENTS

The evaluation team was assisted throughout this process by many people. Without their help, frank comments and collaboration, this evaluation could not have been completed. We have valued enormously these ideas and experience. Any errors or omissions are ours and not because we were not provided adequate information.

We would like to express special thanks to Miss Nancy Fong, ROCAP Project Officer for her guidance and support; Dr. Carlos Enrique Fernández and his excellent core staff for the background publication ready for our review, travel arrangements made and the company of one of the staff members throughout the field trips in the region. Their help was unstinting and invaluable.

We would like to express a special vote of appreciation to five people that dedicated full time, day and night for almost one week to type, correct and suggest modifications in the organization of this report. Their collaboration and dedication are a credit to IICA and PROMECAFE.

They are:

Mrs. Flory Jiménez
Mrs. Lilian Maycrga
Mrs. Millsen Chaverri
Miss Maritza Hernández
Mr. Carlos Arauz

We are deeply grateful to all that made our work so pleasant and hopefully valuable.

ANNEX 1

ACRONYMS

AID	Agency for International Development
ANACAFE	Asociación Nacional del Café, Guatemala
CABEI	Central American Bank for Economic Integration
CATIE	Centro Agronómico Tropical de Investigación y Enseñanza Turrialba, Costa Rica.
CEPI	Centro de Elaboración de Proyectos de Inversión, IICA.
CICAFE	Centro de Investigaciones en Café - CICAFE, Costa Rica
CIDIA	Centro Interamericano de Información y Documentación Agrícola, IICA.
CIFC	Centro Internacional de Royas del Café, Oeiras, Portugal
CIRAD	Centro Internacional de Cooperación para la Investigación y Desarrollo en Agronomía Tropical, Francia
CORECA	Consejo Regional de Cooperación Agrícola para Centro América, México, Panamá y República Dominicana.
CRIES	Comprehensive Resources Inventory Evaluation System
CP	Conditions Precedent
IAC	Instituto Agronómico de Campiñas, Brasil
IBRD	International Bank for Reconstruction and Development
ICAFE	Instituto del Café, Costa Rica
ICAITI	Instituto Centroamericano de Investigación y Tecnología Industrial, Guatemala.
IDB	International Development Bank
IHCAFE	Instituto Hondureño del Café
IICA	Instituto Interamericano de Cooperación para la Agricultura.

INMECAFE	Instituto Mexicano del Café.
IRCC	Instituto de Investigaciones en Café y Cacao, Francia
ISIAP	Instituto Salvadoreño de Investigación Agraria y Pesquera
ISIC	Instituto Salvadoreño de Investigaciones del Café.
qq	100 libras (45.36 Kgrs.)
MAG	Ministerio de Agricultura y Ganadería
MIDA	Ministerio de Desarrollo Agropecuario, Panamá.
MIDINRA	Ministerio de Desarrollo Agropecuario y Reforma Agraria, Nicaragua.
MRN	Ministerio de Recursos Naturales, Honduras.
OIRSA	Organismo Internacional Regional de Sanidad Agropecuaria.
PACD	Project Assistance Completion Date
PIADIC	Proyecto de Información Agropecuaria del Istmo Centroamericano
PROMECAFE	Programa Cooperativo para la Protección y Modernización de la Caficultura en México, Centro América, Panamá y El Caribe.
ROCAP	Regional Office for Central America and Panama, AID.
SEA	Secretaría de Estado de Agricultura, República Dominicana.
UFV	Universidad Federal de Vicosa, Brasil.
USDA	United States Department of Agriculture, Washington, D.C.

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ANNEX 2

ORGANIZATIONS AND PERSONS INTERVIEWED BY COUNTRY

COSTA RICA

MINISTRY OF AGRICULTURE (MAG):

Gerardo Hidalgo, Head of the Coffee Department and Director of the ICAFEMAG Cooperative Program

Jorge Benavides, Assistant Plant Breeder Coordinator

Enrique Jiménez, Research Activities Coordinator

COFFEE INSTITUTE (ICAFE):

Mario Fernández Urpí, Executive Director

Rodrigo Cleves, Head of CICAFE

INTERAMERICAN INSTITUTE FOR COOPERATION ON AGRICULTURE (IICA):

Martín E. Piñeiro, Director General

Harlan L. Davis, Deputy Director

Eduardo Trigo, Director of Program II

Rodolfo Martínez Ferraté, Central Area Operational Director

Carlos Enrique Fernández, Head of PROMECAFE

Eduardo Andrade M., Agricultural Communication Sepecialist, PROMECAFE

Carlos Arauz F., Project Manager Specialist, PROMECAFE

Alfredo Alvear, Head of The International Agricultural Documentation and Information Center (CIDIA)

TROPICAL AGRICULTURE RESEARCH AND TRAINING CENTER (CATIE):

Rodrigo Tarté, Director

Oscar Fonseca, Deputy Director

Carlos Burgos, Head of the Crop Production Department

Víctor Villalobos, Genetic Resources Coordinator

Ludwig Muller, Tissue Culture Laboratory Coordinator

Jorge Hernán Echeverri, Coordinator of Development and Testing of Rust Resistant Varieties, PROMECAFE

Marc Berthouly, Tissue Culture Specialist IRCC/France

Nidia Morera, Central Plant Breeding Unit Researcher

André Helfenberger, Colaborator Farmer, La Margarita Farm, Turrialba

EL SALVADOR

MINISTRY OF AGRICULTURE (MAG):

Gregorio Elías Valladares, Viceminister

SALVADORIAN COFFEE RESEARCH INSTITUTE (ISIC):

Manuel Flores Berríos, Director

Carlos Ernesto Romero A., Deputy Director

Cecilia Gálvez, Head of the Plant Pathology Department

María Isabel de Nuñez, Head of the Agricultural Chemistry Department

Francisco A. Ríos Lazo, Head of the Department of Genetics

Armando Alabí, Head of the Department Agricultural Engineering

Doris Moreno, Researcher

Fabio Bautista, Researcher

Roberto Lazo, Technology Transfer

NATIONAL COFFEE INSTITUTE (INCAFE):

Jorge Hernández Gutiérrez, Executive Director

Rodrigo Sicilia, Agricultural Division Manager

Efraín Fúnez, Technical Coordinator

PLANT HEALTH INTERNATIONAL AND REGIONAL ORGANIZATION (OIRSA):

Guillermo Otero, Plant Health Coordinator

Rafael Mata, Department Head

Gerardo Ortíz, Department Head

INTERAMERICAN INSTITUTE FOR COOPERATION ON AGRICULTURE (IICA:

Carlos Rucks, Representative

Zía U. Javed, Plant Pathology Specialist

GUATEMALA

MINISTRY OF FOOD AND AGRICULTURE (MAGA):

Rodrigo Estrada Hurtarte, Minister

NATIONAL COFFEE ASSOCIATION (ANACAFE):

Manuel Castro M., Agriculture Vice Manager

Francisco Anzueto, Head of the Research Department

Humberto Jiménez G., Head of the Soil Laboratory

Rigoberto San Juan, Researcher

Antonio Sánchez, Plant Protection

Jesús Alvarado, Technical Assistance

Gustavo Figueroa, Researcher

Arturo Villeda S., Mineral Nutrition Researcher

MEXICO/GUATEMALA COMISSION FOR COFFEE LEAF RUST:

Giovanni Rey, Director

CENTRAL AMERICAN INSTITUTE OF RESEARCH AND INDUSTRIAL TECHNOLOGY (ICAITI):

J. Fernando Mazariegos A., Head of the Division of Analysis and Testing

Julia Alicia de Zeissig, Researcher

Tomás Prieto P., Researcher

INTERAMERICAN INSTITUTE FOR COOPERATION ON AGRICULTURE (IICA)/GUATEMALA:

Armando Reyes, Country Director

Norberto Urbina, Entomologist

Bernard Decazy, Entomologist, IRCC Adviser

HONDURAS

MINISTRY OF NATURAL RESOSURCES:

Rodrigo Castillo, Minister

HONDURAN COFFEE INSTITUTE (IHCAFE):

Ramiro Rodríguez Lanza, General Manager

Francisco Alberto Rodezno, Deputy General Manager

Rubén Guevara, Head of the Agricultural Division

Julio A. González, Head of the Coffee Extension Department

Edwin A. Flores Rodríguez, Plant Breeding Program Coordinator

Raúl Núñez Hernández, Entomology Program Coordinator

Oscar Octavio Torres Paz, Training Officer

Virgilio Chicas, Extension Agent

Alexis Matute, Profile Area Coordinator

Andrés Rubio, Head of the Comayagua Region

José Jainez, Acting Head of Audiovisual and Photography Section

INTERAMERICAN INSTITUTE FOR COOPERATION ON AGRICULTURE (IICA):

Alberto Franco, Representative

Gilberto Vejarano, Communication Specialist

PANAMA

MINISTRY OF AGRICULTURAL DEVELOPMENT (MIDA):

RIO SALERO:

Antonio Montenegro, Head of the Agency

Arturo Espinosa, Acting Head of the Coffee Program

Luis E. Castañeda V., Technical Assistance in Coffee

BOQUETE:

Edgardo Miranda, Coffee Program Supervisor

Francisco A. Serracín, Crop Management

Marachino Hurtado P., Validation Trial Program

Crispiliano Contreras, Technical Assistance, Spraying Equipment Evaluation.

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ANNEX 3

MICROCUTTING METHODOLOGY

This new process for multiplying coffee as clones, rather than sexually reproduced lines or varieties, offers an extremely important new tool to the coffee industry. It can reduce the time from selecting a new high yielding rust resistant selection to commercial application by thirty to fourty years. It appears also possible to multiply this material at prices competitive with that of seed reproduction, now used throughout the hemisphere.

PROMECAFE and IRCC scientists have to date grown over 100,000 plants using the new system. The resulting plants are vigorous and very well formed. To the untrained eye they look like excellent seedlings.

Since the procedure is not published (it will be in the next several months), full details will not be presented here. However, the main steps in the process include:

1. Establishment of an in vitro Germ Bank.

Cuttings of one node are taken from orthotropic stems of selected mother trees. The leaves are removed, they are washed then disinfected chemically in the laboratory and planted in a nutrient solution under aseptic conditions (see following Diagram).

2. Multiplication Phase.

After three months, the first young shoots that have grown on these cuttings are cut. They are divided into very small single node cuttings with two levels. These small cuttings are planted under aseptic conditions in nutrient solution. Each first generation cutting will produce six or more new cuttings after eighty days.

These small microcuttings are allowed to grow and are again divided into more microcuttings every eighty days.

3. Production of nursery plants

When adequate material is available, microcuttings of three to six small nodes area cut, treated with a rooting hormone and planted in plastic bags in a soil/sand/coffee pulp rooting mixture. The plastic bags are placed in a high humidity chamber. After thirty days, roots begin to develop. When roots have developed adequately, the moisture level in the air is gradually reduced and the new plants are grown, until they are ready for field planting the same as if they were reproduced from seed.

From one mother plant, it is estimated that over 10,000 clonal plants can be produced the first year and millions / the third year at a cost about equal to seed reproduced plants.

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ANNEX 4

1984 MID-TERM EVALUATION

RECOMMENDATIONS AND PROMECAFE ACTIONS TAKEN

1. "From now to the end of the Project, new introductions to CATIE should be made wisely and more emphasis should be placed on making preliminary selections of rust resistant material available to the countries so that they, in turn, speed-up their efforts to adapt the material to local conditions. It is also necessary to determine which varieties are best suited for distribution to small farmers within a reasonable period of time (although it is unlikely that this can be done during the life of the Project)."

1987 STATUS

PROMECAFE and CATIE have taken this recommendation seriously because of the need to focus on important plant differences, rather than interesting ones, as well as their limitation in land and personnel to handle large numbers of new selections in this collection.

The regional trials sent to the countries are now focusing much more on lines and crosses that have been first screened at CATIE and have rust resistance. Data being accumulated at CATIE and in the countries will soon permit them to develop a methodology to reduce the number of lines and plants by an estimated fifty percent in two years and an additional thirty to fourty percent in four to five years, after the line is in production.

2. "A more logical and practical use of tissue cultured coffee plants would be as a means of reproducing outstanding progeny-tested individual plants in sufficient numbers for establishing seed gardens in the member countries. These progeny-tested trees, established in sufficient numbers

for seed gardens, would have previously been tested for rust resistance, productivity, uniformity and quality of their seedling progeny. Seed from these seed gardens would then furnish rust resistant seedlings of sufficient quality for commercial planting in rust infected areas where it is no longer feasible to plant susceptible varieties."

These improved seedlings could be grown in conventional nurseries by coffee growers in the traditional manner This would eliminate the need for large numbers of expensive tissue cultured clonal progenies, which may or may not perform satisfactorily in the field because of weak root systems.

These progeny-tested seedlings would also be much cheaper to produce, grow in the nursery, and establish in the field than tissue cultured plants.

Cost factors would become a major deterrent to propagation of large numbers of tissue cultured plants required for field planting. On the other hand, production of progeny-tested seedlings would be in the same cost range as traditionally grown rust susceptible seedlings.

1987 STATUS

This recommendation of the Mid-term evaluation team is based on conventional plant improvement methods and an assumption that tissue culture could not compete in cost with seed multiplied plants or have a satisfactory root system. It also assumes that the progeny selected for yield, agronomic adaptability and quality will be sufficiently uniform morphologically and genetically to be seed reproduced commercially after asexual reproduction to produce seed gardens.

The research carried out at CATIE on microcuttings now promises a new era in coffee plant improvement. The new system can reproduce over 10.000

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clonal plants from one mother tree in the first year. Several million could be reproduced in the second and third years. The plants can be grown at an estimated cost (not yet confirmed at the commercial level but ready for testing) rivaling seed production and genetically pure offspring from the mother tree. Since the cost of plants is a very small part of the total cost of commercial production, even if per plant costs were double that of seed, it would still be an excellent investment.

There is no scientific evidence to support the idea that the root system of asexually reproduced coffee plants is inferior to seedlings. Plants have been grown from conventional cuttings and commercially planted in India and the Ivory coast for decades. Research on the use of cuttings at Turrialba in the 1950's, showed that these plants could be brought into production at an earlier age and grew well for at least the first eight years (special observation of these plants stopped at that time, due to their removal for the construction of buildings).

The selection programs being carried out in the countries on individual plants and crosses are beginning to identify outstanding plants and lines that are resistant to rust and are producing crops much larger than current commercial varieties (Caturra, Catuai and Mundo Novo). After three years of production (the oldest regional experiment) the best lines are producing up to fifty percent more cherry and green bean. The best individual plants of the best lines are producing up to 300% more than commercial varieties.

To make these rust resistant crosses reproduceable by seed will require thirty to fourty years. By reproducing them via microcuttings, this long delay in securing uniform progeny by sexual reproduction is eliminated. This cost and timesaving is very large and of itself could justify the entire project.

Since the Mid-term evaluation, the situation of the PROMECAFE tissue culture work at CATIE has improved enormously. The leadership role for this component has been ably filled by the IRCC tissue culture advisor assigned to the project.

Laboratory procedures have improved and methodologies refined so that now much higher survival rates of tissue culture plantlets are being obtained. Major efforts in the future will be in refining microcutting techniques and in training national technicians in this methodology. Problems of transplanting these cuttings from the petri dishes to soil media have been overcome and survival rates of over 95% are obtained.

3. "The Evaluation Commission has been made aware of problems concerning certain aspects of the administration and coordination of activities in the plant tissue culture program.

R.: IICA/PROMECAFE and CATIE should:

a. Clearly define the lines of coffee research to be carried out in order to meet the specific goals of the PROMECAFE/ROCAP project.

b. Resolve the problem of administrative authority which at the present time is not properly defined and has resulted in personal disagreements among the technical staff.

c. Define the extent to which non-PROMECAFE activities are to be carried out in the laboratory and establish norms and procedures for the proper use of laboratory facilities.

In addition, it is essential that CATIE take immediate action to rectify the problems of laboratory design and equipment which have resulted in problems of contamination and inefficiency.

The Commission feels that the July 30, 1984 memorandum of Jose Galindo and Franklin Rosales, addressed to the CATIE Director (See Annex 12) on the subject of the function of the tissue culture laboratory, be accepted and implemented to the extent possible and at early date.

The participation and assistance of the Head of PROMECAFE and the senior administrative Officials of CATIE, actively cooperating together, is essential to resolve these issues."

1987 Status

A. PROMECAFE has made great strides in better defining the lines of coffee research. These clearly follow the project terms of reference. With the increased capacity of national technicians as a result of national and regional training as well as the colaboration of the French coffee specialists and Dr. Javed, the major focus of Rust, Broca, tissue culture and information transfer research strategy has been developed. As progress has been made in research, the program has been modified in quarterly coordination workshops.

B. Dr. C. E. Fernández is clearly the overall manager of the program. He has resolved personality problems among the staff regionally and at the national interface. The program appears to now be moving ahead smoothly. No personal conflicts were reported to the Final Evaluation team.

C. Progress has been made in this area but more needs to be done. There is a working agreement among the CATIE/PROMECAFE scientists that has helped resolve the issues, as has the construction of additional facilities.

4. "The Project Plant Pathologist should maintain more frequent and close contact with national counterparts in the other countries in addition to where he is stationed. In certain selected areas, research on chemical control combined with cultural control levels should be considered."

1987 Status

Dr. Javed terminated his participation in the project on March 13, 1987 because he was not sure the project would continue and a new challenge was presented to him. He did an excellent job and promoted effective coordination among the national research groups.

The recommendation remains valid. A senior coffee pathologist will continue to be needed if the project is continued. Further important work is needed on screening fungicides, determining how best to deal with the residue issue and build an indexing system so that producers will know when it is economically and pathologically the best time to spray.

5. "The services of a Project Entomologist with sufficient knowledge and experience in coffee and the coffee bean borer to up-date these activities, are urgent. Besides chemical control, cultural control of this pest must be considered of great importance and it is advisable that contact with other countries having experience on cultural control of the coffee bean borer be established. In regard to chemical control, other insecticides besides endosulfan should be tried out."

1987 Status

PROMECAFE had a difficult time locating an entomologist experienced in coffee berry borer (CBB). When one was located he had accepted another position. In February 1985 the Project employed Mr. Norberto Urbina

(M.Sc., Fla. State) who has been made responsible for the CBB work in Guatemala (where he lives) as well as assists in the El Salvador and Hondurean programs. In addition, the IRCC of France located a senior coffee entomologist in Guatemala in April of 1985. Dr. Benard Decazy has played a major role in orienting the lead CBB research program in Guatemala and has taught in several courses. Mr. Urbina continues to assist the El Salvador and Honduras activities, as well as collaborate in the Guatemala effort.
There is still a need for more effective coordination in the three countries, although there has been marked improvement in the research and transfer of results to producers since 1984.

Work has continued on screening insecticides for potential use in CBB control. Some thirty materials have been tested in the field and laboratory, yet none surpass "Endosulfán" (Thiodan) to date. This work must be continued until alternatives are found.

Good progress has been made in testing the value of plantation sanitation for CBB control. The results are now being disseminated to producers in the affected countries.

6. "As soon as possible, make a decision relative to the observations included in the Cummings Report and, if necessary, proceed to discuss and sign work agreements with OIRSA, ISIC, CENTA and ICAITI to begin this activity early in 1985."

1987 Status

This recommendation for the gathering of samples and pesticide residue analyses in chemical control of rust and the coffee bean borer, continues to be valid, although Dr. Cummings' recommendation has been resolved. Some important work has been carried out on residues; however, it has

raised as many questions as it has answered. Further work in this important area is strongly supported.

7. "a. Perfect training in rust and intensify this activity as it pertains to the coffee bean borer, in countries away from the region.

b. Increase training in transference and validation of technology."

1987 Status

Project overseas training has been completed. Several national technicians, under the sponsorship of IRCC, are still in off-shore instructional programs.

Numerous training courses have been given by PROMECAFE staff in broca and rust technology transference and validation. All coffee offices and their technicians have participated in these events. Three countries are now using the PROMECAFE area profiles and group methodology for extension of their improved technology packages.

8. "Intensify in all the countries "area profile" studies in order to develop and validate a methodology for the production, adaptation and transfer of coffee technology to small farmers. This methodology should be suited to:

a. Accomplish the integration of researchers, extensionists and small coffee growers.
b. Contribute to the proposed model for the transfer of technology.
c. Work with organized groups of small coffee growers.
d. Allow for less general and more specific recommendations.
e. Achieve a greater integration of the activities of PROMECAFE.
f. Cooperate in the preparation of plans for Integrated Agricultural and Rural Development."

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1987 Status

At this final evaluation there was a general consensus among member countries that the systems approach used by PROMECAFE to describe present production conditions and develop site specific first approximation tecnology packages was quite successful. Yield increases, even of low technology recommendations, were very impressive. The team was not in accord with item (f), in that PROMECAFE should participate very actively in integrated agricultural or rural development activities.

9. "The activity calling for a regional information system and data bank has been timidly initiated. The PROMECAFE/ROCAP Project hired a Consultant to cover this matter and recommend the action to be taken. A final report has been submitted to PROMECAFE.

   R.: In concurrence with the countries, PROMECAFE must proceed to make a decision on the recommendations offered by the Consultant so that, at the end of the Project, at least a basic methodology to strengthen this activity is available."

1987 Status

Little has been accomplished in this area since the mid-term evaluation. Two minor sub-systems have been started, one to assist with genetic data management of rust resistant varieties, and a documentation control and retrieval program. The creation of a regional data base and CRIES extrapolation program that was to be accomplish by PIADIC technicians and PROMECAFE staff will not be accomplished as planned by the PACD.

10. "In Section 10 of this report, the Evaluation Commission has expressed its comments and suggestions relative to the cooperating organizations, CATIE and OIRSA.

R.: The Administration of PROMECAFE should exchange with CATIE and OIRSA more information relative to the areas of common interest and jointly discuss and prepare a document, which in a more realistic manner, updates Operational Agreements in force and more effective participation and coordination achieves in the PROMECAFE/ROCAP Project."

1987 Status

Little seems to have taken place in this area after the last evaluation. Project documentation does not show that either CATIE or OIRSA entered into a new operational agreement or that their role as investigation leaders was transferred with the concurrence of ROCAP to PROMECAFE staff.

11. "At the end of the ROCAP Project in May 1986, there will be an unspent balance of a little over US$656.000.00.

R: In concurrence with the countries, PROMECAFE should negotiate with AID/ROCAP an extension of the present Project in order to continue financing some activities considered of first priority and necessary to raise the social and economic level of small coffee growers. PROMECAFE/ROCAP should promote, within a reasonable period of time, multi-disciplinary meetings with national technicians in order to determine the priority of activities to be financed, if an extension of the AID/ROCAP Agreement is granted.

The Evaluation Commission feels that the following priority activities should be presented to the countries for consideration.

a. Research and training in the coffee bean borer.
b. Training on transfer and validation of technology.
c. Preparation of area profiles and establishment of pilot areas

similar to those in El Salvador and Honduras, in other countries participating in the project."

1987 Status

ROCAP extended the PACD until December 31, 1987. At present there is interest to continue with some kind of a follow-on program if funding becomes available. Much of the investigation work now underway still needs to be continued.

Future tasks of PROMECAFE will depend upon the new five year agreement to be developed at the end of this year between IICA and the member countries.

The training and area profile issues have been treated and will continue to receive attention during the LOP.

12. "The Project must make national technicians more conscious of the close relationship and communication that must exist between the researcher, the comunicator/extensionist and the farmer.
Crop technology and control of its pests should be viewed as the solution to the social and economic problems, small coffee growing farmers and therefore all Project activities should be focused towards the promotion of integrated development in the coffee growing areas of the region.
The Head of the Project should be responsible for this orientation."

1987 Status

The total integration of PROMECAFE methodologies, components and recommendations into one multi-disciplinary strategy or general application mode has not yet taken place. The various new techniques being used may not be mature enough by the PACD for this to happen. However, great progress has been made in this area.

The team would again point out that there must be clearly understood limits on where a technification project must stop. PROMECAFE was not designed as an integrated rural development project nor should it assume this role.

13. "The Head and technicians of the ROCAP Project should strengthen cooperation and reciprocal assistance of the Project with the respective national authorities and OFICAFE officials should transact the signing of the PROMECAFE Agreement."

1987 Status

This recommendation remains valid and is strongly supported by this evaluation team. ROCAP has not apparently maintained as close liason with the USAID's as needed to encourage them to develop bilateral outreach projects. Further liason is strongly suggested with national authorities so that they know of the valuable progress that has been made by the project and increase their financial support to PROMECAFE and their own national programs. This is especially important if the project is continued.

14. "The Project Specialist in Agricultural Communication should maintain close contacts with the IICA and MIDA representatives to develop a program to meet the Project needs in Panama.
Communications between PROMECAFE and IICA-Panama should be improved to obtain these objectives."

1987 Status

Participation of Panamanian technicians in PROMECAFE extension and communications short courses has not been less that other member

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countries. At this point, the group methodology has not been implemented in Panama. Their present extension system is based on supervised credit. Since rust has arrived in the country, this case may change and the coffee office may need other means to reach a much larger clientele.

15. "The Commission considers that in view of the degree of progress of the Project, logistical support received from IICA, the presence of the ROCAP Office in San Jose, and the research work being done at CATIE, headquarters for the PROMECAFE/ROCAP Project should not be changed."

1987 Status

No change has been made for the PROMECAFE Project headquarters in IICA. This has permitted the project to continue to operate very well.

The ROCAP ADO has been moved to Guatemala although the ROCAP office continues in Costa Rica. Where previously all vouchers were sent to the Costa Rican office they now go directly to Guatemala. Miss Fong, located in the Guatemala ROCAP Office is in full control of the project. There appears to be little managerial difficulty because of this change in organization and the project is moving ahead at a satisfactory pace.

16. "Regional activities of the PROMECAFE/ROCAP Project should be continued and broadened and with this satisfactory experience, support should be given to other similar projects that allow better reciprocal cooperation among countries, institutions and technicians through the exchange of knowledge and experience in areas of common interest."

1987 Status

This is an excellent recommendation. The results of this initiative should be considered for cacao, rubber, tropical fruits, etc. The benefits of regional cooperation in this project and the training of

national technicians has made a major difference in this crop's potential on small farms. The length of the project has not been adequate to fully demonstrate its real potential. Nevertheless it can serve as a valuable model for other similar efforts.

17. "All the countries expressed to the Evaluation Commission their concern and interest relative to diversification in coffee growing regions. The following actions could be undertaken:

    a. Competent national authorities should look for support for specific diversification projects in this area of interest by contacting local AID offices.

    b. PROMECAFE should make an inventory of projects and studies on the subject that have been carried out in the area, identify alternatives that the farmers themselves have developed and, on this basis hold a seminar to discuss the approach to diversification.

    c. A IICA/PROMECAFE-AID/ROCAP regional project should be negotiated through IICA-PROMECAFE to initiate or reinforce national and regional diversification programs."

1987 Status

a. This team has not looked into the USAID portfolios closely enough to determine country actions and USAID response on this suggestion. A regional agricultural export promotion activity is supported by ROCAP. USAID/Honduras is reported to have a similar activity and CABEI is assisting in this area.

b. PROMECAFE has not made such a study.

c. No such action has thus far been developed by ROCAP or IICA. We would feel that PROMECAFE should not expand into crop diversification. It already has a full plate. If it is undertaken, it will probably focus on other ecological areas that are not producing coffee.

18. "The Head of PROMECAFE must maintain close contacts and exchange information with all national institutions and projects connected with coffee growing and promote coordination between and within them."

1987 Status

The present team leader is not the same person as during the 1984 evaluation. There is still a need for better coordination between PROMECAFE, national offices and USAID's in each country. Much work remains to be done by IICA in increasing the knowledge level of key country institutions about PROMECAFE.

19. "The Head of PROMECAFE should advise CORECA that the subject of coffee growing and a report of the progress of the ROCAP Project and its future actions should be included in the next Meeting of the Consejo Regional de Cooperacion Agricola (CORECA)."

1987 Status

We understand that CORECA will review the PROMECAFE program at their 1987 meeting. This is important to set the stage for a possible extension of the PROMECAFE project after December 1987.

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