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DEPARTMENT OF STATE
AGENCY FOR INTERNATIONAL DEVELOPMENT
Washington, D.C. 20523

PANAMA

PROJECT PAPER

AGRICULTURAL TECHNOLOGY DEVELOPMENT

AID/LAC/P-028

Project Number:525-0180
Loan Number:525-T-050

UNCLASSIFIED

DEPARTMENT OF STATE
AGENCY FOR INTERNATIONAL DEVELOPMENT
WASHINGTON, D.C. 20523

ASSISTANT
ADMINISTRATOR

Loan No. 525-T-050
AID/LAC/P-028

PROJECT AUTHORIZATION AND REQUEST FOR ALLOTMENT OF FUNDS

Name of Country: Panama

Name of Project: Agricultural Technology Development

Project Number: 525-0180

Pursuant to Section 103 of Part I, Chapter 1 of the Foreign Assistance Act of 1961, as amended, I hereby authorize a Loan and a Grant to the Republic of Panama (the "Cooperating Country") of not to exceed Six Million United States Dollars ($6,000,000) (the "Authorized Loan Amount") and Five Hundred Thousand United States Dollars ($500,000) (the "Authorized Grant Amount") to help in financing certain foreign exchange and local currency costs of goods and services required for the project described in the immediately following sentence. The project will finance technical assistance, training, equipment and materials and construction which will assist Panama's Applied Agricultural Research Institute (IDIAP) to establish an agricultural research capability and to conduct research activities in approximately eight priority areas of Panama.

I approve the total level of AID appropriated funding planned for this project of Seven Million United States Dollars ($7,000,000), of which $6,000,000 will be Loan funded and $1,000,000 Grant funded, including the funding authorized above, during the period FY 79 through FY 1980. I approve further increments during that period of Grant funding up to $500,000, subject to the availability of funds in accordance with AID allotment procedures.

I hereby authorize the initiation of negotiation and execution of Project Agreements by the officer to whom such authority has been delegated in accordance with AID regulations and Delegations of Authority, subject to the following essential terms and covenants and major conditions, together with such other terms and conditions as AID may deem appropriate:

A. Interest Rate and Terms of Repayment

The Cooperating Country shall repay the Loan to AID in United States Dollars within twenty (20) years from the date of first disbursement of the Loan, including a grace period of not to exceed ten (10) years. The Cooperating Country shall pay to AID in United States Dollars interest from the date of first disbursement of the Loan at the rate of (a) two percent (2%) per annum during the first ten (10) years and (b) three percent (3%) per annum thereafter, on the outstanding disbursed balance of the Loan and on any due and unpaid interest accrued thereon.

B. Source and Origin of Goods and Services

Except for ocean shipping, goods and services financed by AID under the Loan shall have their source and origin in the Cooperating Country or in countries which are included in AID Geographic Code 941, except as AID may otherwise agree in writing. Ocean shipping financed under the Loan shall be procured in the United States or in the Cooperating Country, except as AID may otherwise agree in writing. Goods and services financed by AID under the Grant shall have their source and origin in the Cooperating Country or in the United States except as AID may otherwise agree in writing. Ocean shipping financed under the Grant shall be procured in the United States, except as AID may otherwise agree in writing.

C. Condition Precedent to Initial Disbursement

Prior to any disbursement, or to the issuance of any commitment documents under the Project Agreement(s), the Cooperating Country shall furnish in form and substance satisfactory to AID:

1. A detailed implementation plan for the first year of the Project that provides a schedule for the procurement of Project inputs including technical assistance, training, and commodities; that outlines the Cooperating Country actions required prior to use of the Project inputs; and that describes how such input will contribute to Project activities.

D. Conditions Precedent to Disbursement for Field Activities in Each Geographic Area

Prior to any disbursement, or to the issuance of any commitment documents under the Project Agreements for field

research and validation trials in each of the approximately eight priority geographic areas, the Cooperating Country shall furnish in form and substance satisfactory to AID:

(1) Evidence that required diagnostic studies have been completed and analyzed and a research plan developed for such geographic area, which shall include an analysis of the need for complementary inputs and a description of the arrangements for obtaining them.

(2) A plan from the Ministry of Agricultural Development which describes the role, personnel and other contributions of each institution that will be involved in the dissemination of the results of the research to Panamanian small farmers, including a specific plan for the participation and training of Ministry of Agricultural Development personnel in this activity.

(3) A detailed plan for the use of long-term technical assistance in carrying out the research activities and evidence that arrangements have been made to obtain the technical services specified in the plan.

E. Condition Precedent to Disbursement from the Research Fund

Prior to any disbursement, or to the issuance of any commitment documents under the Project Agreements for research contracts financed by the IDIAP research contracts fund, IDIAP will furnish in form and substance satisfactory to AID, a plan for the use of such funds.

F. Covenant

The Cooperating Country covenants that, prior to the procurement or use of any pesticide financed under the Project agreement(s), it will confer with AID/Panama regarding the proposed procurement or use of the pesticide and will jointly prepare with AID/Panama and describe in writing a plan as to how the pesticide will be used and the safeguards to be followed.

Edward W Cox
Assistant Administrator
Bureau for Latin America
and the Caribbean

Sept 7 1979
Date

Clearances:

GC/LAC, J. Kessler JK/HO date 9/5/79
LAC/DR, C. Leonard CL date 9/5/79
LAC/DR, R. Mathia RM date 9/5/79
LAC/DR, M. Brown MB date 9/5/79
LAC/CEN, W. Luken WL date 9/5/79

Drafted:GC/LAC:SWhitman:ec:8/16/79:x29182
Revised:GC/LAC:SWhitman:ec:9/5/79

AGENCY FOR INTERNATIONAL DEVELOPMENT

PROJECT PAPER FACESHEET

1. TRANSACTION CODE: [A] (A = ADD, C = CHANGE, D = DELETE)

PP

2. DOCUMENT CODE: 3

3. COUNTRY/ENTITY: PANAMA

4. DOCUMENT REVISION NUMBER:

5. PROJECT NUMBER (7 digits): 525-0180

6. BUREAU/OFFICE: A. SYMBOL: LA; B. CODE: 05

7. PROJECT TITLE (Maximum 40 characters): Agricultural Technology Development

8. ESTIMATED FY OF PROJECT COMPLETION: FY 84

9. ESTIMATED DATE OF OBLIGATION: A. INITIAL FY 79; B. QUARTER 4; C. FINAL FY 80 (Enter 1, 2, 3, or 4)

10. ESTIMATED COSTS ($000 OR EQUIVALENT $1 =)

A. FUNDING SOURCE	FIRST FY B. FX	FIRST FY C. L/C	FIRST FY D. TOTAL	LIFE OF PROJECT E. FX	LIFE OF PROJECT F. L/C	LIFE OF PROJECT G. TOTAL
AID APPROPRIATED TOTAL	3444	3056	6500	3794	3206	7000
(GRANT)	(400)	(100)	(500)	(750)	(250)	(1000)
(LOAN)	(3044)	(2956)	(6000)	(3044)	(2956)	(6000)
OTHER U.S. 1.						
OTHER U.S. 2.						
HOST COUNTRY	0	500	500	113	6887	7000
OTHER DONOR(S)						
TOTALS	3444	3556	7000	4400	7786	14000

11. PROPOSED BUDGET APPROPRIATED FUNDS ($000)

A. APPROPRIATION	B. PRIMARY PURPOSE CODE	PRIMARY TECH. CODE C. GRANT	PRIMARY TECH. CODE D. LOAN	E. 1ST FY 79 F. GRANT	E. 1ST FY 79 G. LOAN	H. 2ND FY 80 I. GRANT	H. 2ND FY 80 J. LOAN	K. 3RD FY — L. GRANT	K. 3RD FY — M. LOAN
(1) FN	121	080	080	500	6000	500			
(2)									
(3)									
(4)									
TOTALS				500	6000	500			

A. APPROPRIATION	N. 4TH FY — O. GRANT	N. 4TH FY — P. LOAN	Q. 5TH FY — R. GRANT	Q. 5TH FY — S. LOAN	LIFE OF PROJECT T. GRANT	LIFE OF PROJECT U. LOAN
(1) FN					1000	6000
(2)						
(3)						
(4)						
TOTALS					1000	6000

12. IN DEPTH EVALUATION SCHEDULED: MM 07 YY 80

13. DATA CHANGE INDICATOR. WERE CHANGES MADE IN THE PID FACESHEET DATA, BLOCKS 12, 13, 14, OR 15 OR IN PRP FACESHEET DATA, BLOCK 12? IF YES, ATTACH CHANGED PID FACESHEET.

[1] 1 = NO, 2 = YES

14. ORIGINATING OFFICE CLEARANCE

SIGNATURE:

TITLE: Director, USAID/Panama

DATE SIGNED: MM 07 DD 20 YY 79

15. DATE DOCUMENT RECEIVED IN AID/W, OR FOR AID/W DOCUMENTS, DATE OF DISTRIBUTION: MM 07 DD 25 YY 79

AID 1330-4 (3-78)

AGRICULTURAL TECHNOLOGY DEVELOPMENT
PROJECT

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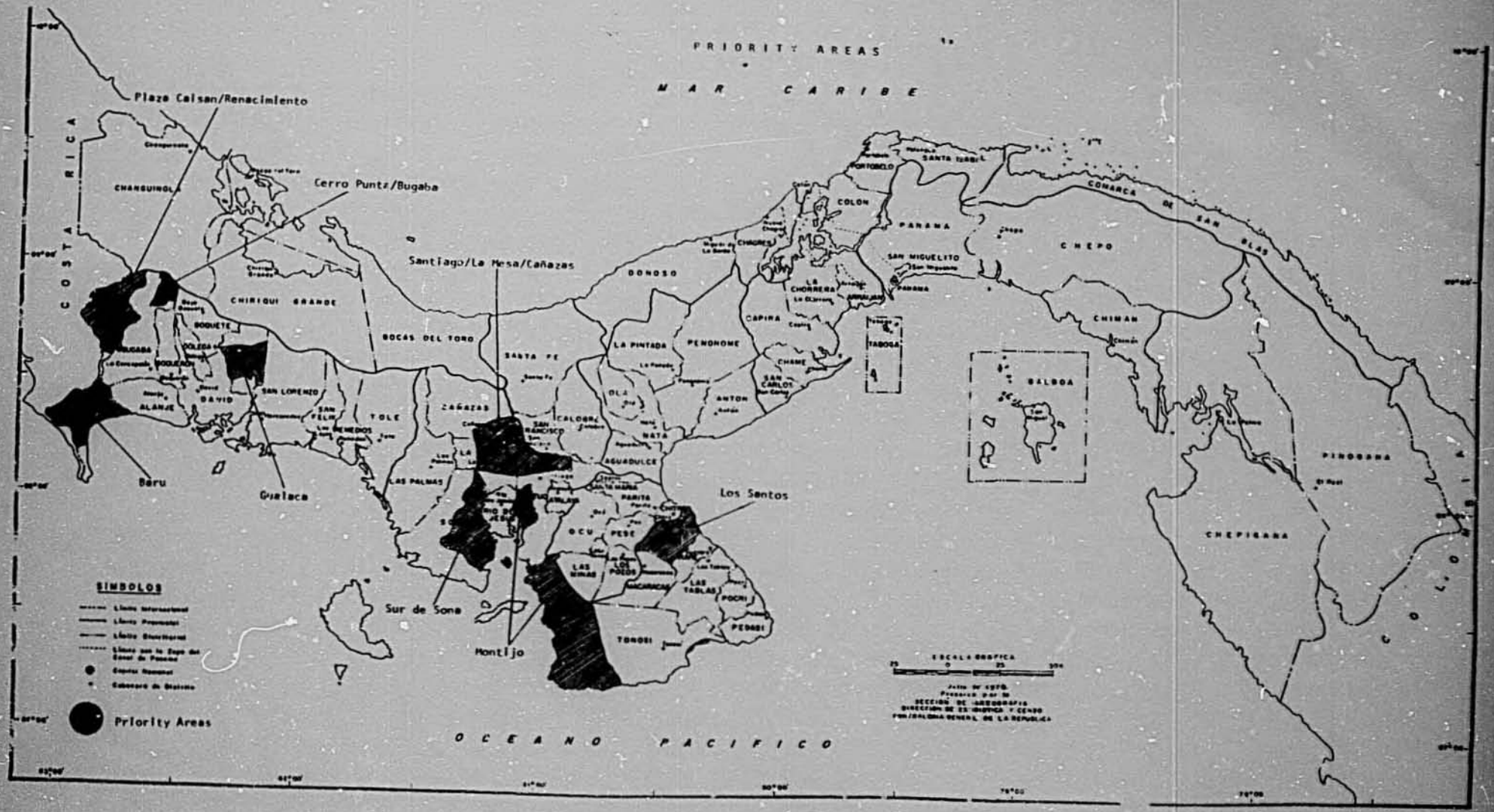
* These Annexes are on file in LAC/DR.


PRIORITY AREAS
MAR CARIBE
COSTA RICA
Plaza Calsan/Renacimiento
Cerro Punta/Bugaba
Santiago/La Mesa/Cañazas
Baru
Gualaca
Sur de Sona
Montijo
Los Santos
CHANGUINOLA
CHIRIQUI GRANDE
BOCAS DEL TORO
BOQUETE
BOQUERON
VOLCAN
DAVID
ALANJE
SAN LORENZO
SAN FELIX
LOS MEDIOS
TOLE
SANTA FE
ZAÑAZAS
SAN FRANCISCO
CALOBRE
LAS PALMAS
LA PINTADA
PENONOME
DONOSO
CHAGRES
COLON
PANAMA
SANTA ISABEL
PORTOBELO
CONARCA DE SAN BLAS
CHEPO
SAN MIGUELITO
LA CHORRERA
CAPIRA
CHAME
SAN CARLOS
ANTON
OLA
NATA
AGUADULCE
PARITA
OCU
PESE
LAS MINAS
LOS POZOS
MACARACAS
LAS TABLAS
POCRI
PEDASI
TONOSI
TABOGA
BALBOA
CHIMAN
PINOGANA
CHEPIGANA
GOLFO DE PANAMA
OCEANO PACIFICO
SIMBOLOS
Priority Areas
ESCALA GRAFICA

I. SUMMARY PROJECT DESCRIPTION

The purpose of the project is to assist Panama to establish an agricultural research capability that will help small operators increase their land and labor productivity and ultimately their income and employment opportunities. The research program to be adopted is basically one of applied, as contrasted to basic research. Emphasis will be given to adapting production technology that has already been generated in other parts of the world to Panama conditions rather than creating new knowledge. Another salient characteristic of the program is that, for the most part, the research is field-oriented as contrasted to experiments conducted under controlled conditions on an enclosed station or in a laboratory. Researchers from Panama's Applied Agricultural Research Institute (IDIAP) will perform trials, tests, and evaluations on farms under the same basic conditions faced by the actual operators.

The project will finance technical assistance, training, equipment and materials and construction which will assist IDIAP to establish this research capability and to conduct research activities in eight priority areas of Panama. Total project funding is U.S. $14,000,000 of which $7,000,000 are loan/grant funds and $7,000,000 are counterpart. The A.I.D. contribution consists of $6,000,000 in loan funds and $1,000,000 in grant funds.

II. BACKGROUND

A. Overview of Agricultural Sector

Although Panama is best known for its international trade and commercial operations, it is important to note that in the middle 1970's agricultural production accounts for almost one-fifth of the gross national product, employs about 30% of the labor force and generates nearly one-half of the merchandise exports. Many of the country's most important industries and trade and commercial operations depend directly on processing and marketing farm products. Food and fiber production is one of Panama's most important economic activities and will continue to be in the foreseeable future.

In the decade starting in 1960, the agricultural sector grew at an average rate of almost 5% per annum. A close analysis of this situation, shows that the major source of this growth was export crops, particularly bananas. Crops for domestic consumption grew at half that rate. This sluggish supply growth, juxtapositioned with a demand fed by a high population growth rate and rapidly rising per capita incomes, evidently were responsible for a strong increase in the price of food. This situation contributed to inflationary pressures as well as the need to spend scarce foreign exchange for substantial quantities of farm products.

Beginning in the late 1960's the growth rate of both export crops and crops for domestic consumption declined and has not yet recovered. In fact, the export crop situation has become even more complicated in the middle 1970's. United Brands, the major banana producer, has been involved in a controversy with the GOP over the level of export taxes and, moreover, has become increasingly concerned about political and economic uncertainties. The company has reduced exports from a level of some 23 million boxes in 1970 to 18 million in 1974. Private producers have reacted similarly. Although the Government itself has become involved in the banana business in this period, its exports are relatively small compared to traditional producers.

Domestic crops have been affected by a combination of factors including political and economic uncertainties, droughts and virtual neglect of most private producers by the Ministry of Agricultural Development (MIDA). Since the early 1970's MIDA's credit, technical assistance and other services have been channelled mainly to Government-organized farming communities, (asentamientos). A recent World Bank Report identifies another reason; viz., the growing scarcity of readily accessible land, particularly on the Pacific slope which has supported much of Panama's agricultural expansion. In other words, exhaustion of the agricultural frontier. Not only is new land becoming increasingly scarce but previously-cropped land is declining in fertility from heavy use and neglect of soil conservation. Land in crops actually

declined in the 1960-1970 decade while pasture land increased.

Actually, Panama has very little good, flat land suitable for mechanized agriculture or intensive cattle raising. This situation partially accounts for the historical pattern of settlement and land use, the generally low productivity of land and -- in the case of traditional cropping systems -- of labor, and the large numbers of migratory subsistence farmers who have compounded soil problems by destroying the forest and, inadvertently, initiating devastating erosion. The best soils are found in the alluvia of lower Chiriquí in the west and the Bayano Basin in the east, but there are preliminary indications that the Chucunaque and lower Balsas and Tuira valleys in the Darién may have similar capability. It has been estimated that all total, Panama has less than 200,000 hectares (3% of the country) of Class II soils and only isolated pockets of Class I soils. 1/

Sixty percent of the Class II land is located in three Provinces: Chiriquí (with one-third), Coclé and Veraguas, but the largely unexplored Darién is thought to contain nearly one-third of all the Class III and IV land in the country. Additional soils information may be found in Annex II, Exhibit A.

Some domestic crops, particularly rice, may be considered exceptions to the generalizations above on the growth rate decline of major crops. The Government initiated a basic grains (rice, corn and beans) self-sufficiency program in 1973 utilizing price incentives and credit. The rice support price was increased by 75% between 1973 and 1976 and credit was made available for machinery to large farmers, particularly in the Coclé and Chiriquí provinces. This combination of favorable policy stimulants coupled with the availability of adaptable "green revolution" technologies resulted in an increase of rice production by an annual average of 14% during the 1973-1976 period. Panama had an exportable rice surplus in 1976.

Corn production also increased in this period in response to favorable support prices but domestic supply remained insufficient to meet demand. Since the 1976 crop year, support prices for this crop have not changed. As a result, farmers cultivate other more profitable crops in areas where corn had been produced.

Despite an increase in the support price of beans by 200% during the 1973-1976 period, a simple average of 67% per annum, and large infusions of credit, there was no discernible impact on bean production. In fact, bean production in 1978 was less than it was ten years ago.

1/ Class II has capability for virtually all uses, but requires special, though easily applicable, soil conservation and management practices. Beyond Class III, the land is usually unsuitable for annual crops.

Exhibit B in Annex II shows the index of price supports compared to production indexes of Panama's main staples during the 1973-1978 period. While there was a rather severe drought in the 1976-1977 period which should be taken into account, production of rice and corn seem to have responded favorably to government price incentives. Although beans responded initially, they did not recover following the drought as, evidently, producers turned to other, more profitable enterprises.

With the assistance of international lending institutions and short-term borrowing from private banks, the Government more than tripled the availability of farm credit during the 1968-1975 period. Official lending through the Banco de Desarrollo Agropecuario (BDA) constituted about 30% of the total, channelled to agriculture and livestock which amounted to over $160.0 million in 1977, almost 50% of value added by agriculture. About 40% of the 1977 total was invested in livestock. Since 1973 a major portion of BDA's credit has been invested in the government's collective farming (asentamiento) operations. Many of these loans fell into arrears, however, because of poor management and inefficiencies of the asentamientos. Recently, loans in default have been refinanced and BDA officials claim they will monitor and control more closely all agricultural credit. Credit, along with price incentives, has been an important factor in stimulating production of the basic food commodities. In 1977, total public and private farms credit availability has fallen by over $258 thousand from a 1976 total of $10.5 million. The consensus is that this decline could be attributed largely to a decrease credit demand caused by the drought and government price policy. Evidently, there is no aggregate shortage of loanable funds for agriculture with external assistance from IDB, IBRD, and AID along with funds available from the private banking system. Credit distribution remains a problem, however, especially for those small producers unable to offer title for loan collateral or to whom credit is not attractive under current lending terms.

B. Small Farmer Profile

In its FY 1981 CDSS, the Mission identified 89% of Panama's rural population as living in poverty conditions -- with per capita income of $304 annually. Furthermore, over 16% of the total rural population was classified as living under conditions of "extreme poverty" -- with per capita incomes of less than $160. Geographically, the poor were found to be concentrated in the provinces of Veraguas, Panama, Chiriqui and Colon. The higher incidence of extreme poverty was found in the Veraguas Province with 61% of its population classified as extremely poor.

According to various surveys, most of the rural poor are engaged in subsistence agriculture, have no legal title to the land they work, receive no institutional credit, and utilize very rudimentary production methods. The illiteracy rate is almost 50%, housing and health conditions are extremely poor, and malnutrition is widespread. A shifting agriculture pattern similar to that in Northeast Brazil and the Llanos of Colombia is common, particularly in the Azuero Peninsula and the Darién.

Under prevailing small farm technology, the annual volume of production in 1971 from a five hectare or under farm yields an average income of approximately $800 per farm, in 1978 prices. If there are four family members, this means an annual per capita income of $200. The value of actual outside farm sales, however, is far below that amount. Out of a total 43,500 small farms (under five hectares) in 1970/1971, 25,000 made no sales, and 18,000 had sales of less than $500. More recent data from a 1977 district census of 1,700 farms show 80% of the farms with no sales or sales of less than $500.

Annual survey data obtained subsequent to the census year reveal that the relative production and yields of principal crops produced by small farms (under ten hectares) have changed since 1971: Area planted, yields and production of rice and corn have increased on small farms as compared to larger units. Rice production increased by 49% on small units as contrasted to only 28% on large ones. Area planted in rice and corn were 17 and 13%, respectively, for small and large farms. However, yields of rice and corn on small farms remain 40 to 50% below the yields obtained on large farms.

These surveys also show that the volume of rice utilized for home consumption of the producer, however, increased 49% over the same period. The foregoing would suggest that expansion of rice area by small farms is directly related to the increase in rice production destined for home consumption. Similarly, expansion of corn area on small farms (of some 30%) seemed to be directly related to an increase in the volume of home consumption (30%).

These trends would seem to indicate that subsistence agricul-

ture is as prevalent today as in the previous decade. Although there has been an estimated 10% decline in the number of persons actively occupied in agriculture over the past eight years this fact may be more appropriately attributed to the mechanization of production on larger farms. Estimates based on 1970/1971 census data concerning underemployment in the sector show an equivalent unemployment rate of one-third of the agricultural labor force. Much of this underemployment can be attributed to the cyclical nature of agricultural production, however, the evident lack of modern technology of production and employment especially for the small farmer. This research project will address in part this constraint.

C. Agricultural Marketing Structure for Major Small Farm Products

The market system of Panama for agricultural commodities has played an important role in increased production of basic crops and livestock. Increases in Panama's transport infrastructure have encouraged an expanded degree of commercialization of agricultural production. In addition, the government has established a marketing institute which has assumed an important role in the marketing of a number of staple crops.

A review of Panama's agricultural marketing system was recently carried out by a consultant team at Mission request. (See Annex II, Exhibit E). Basically, the conclusions of the study indicated that the market system, given continued improvement, should be able to support increases in production. In the case of grains, rice is being exported although at prices below domestic levels. Corn is a deficit crop as are beans. Vegetable markets at peak harvest times are probably oversupplied but scarcities exist at other times of the year. However, off-season production with irrigation and production for local markets appears feasible. Also, the development of additional processing facilities can relieve the pressure during harvest periods and allow for expansion. Both milk and pork are being imported while beef has an established export market. The consultants felt that it would be difficult for small producers to penetrate national markets for poultry and eggs, but at the same time, saw no reason why local markets could not absorb some production increases especially, as these products are superior goods.

The Government Marketing Agency (IMA) has been improving steadily over time and will have new storage facilities available in 1981 Given that any production response from farmers due to the IDIAP research program would be two to three years into the future, IMA should have the time necessary to strengthen and improve operations. Its ability to provide an impact on the market and on the small farmer has been demonstrated. For example, in rice and corn, increases in support prices have caused significant increases in acreage planted and the rate of acreage expansion was twice as high for small farmers as for large farmers. Also non-machine planted rice acreage has responded six times as fast to increases in farm support prices as machine planted acreage. Such small farm response indicates that the market system, particularly by IMA, can be very important in creating incentives (or disincentives) to the adoption of technology.

Growth in farm production is clearly related to Government policy. The Government's high level of monetary stimulus for agricultural production through price supports and subsidized credit has resulted in increased production for a number of commodities. Nevertheless, based on historical data, the demand for many commodities will increase more rapidly than their domestic supply. Estimates have been made of balances of two major staples (corn and beans) in 1979, 1980

and then in 1985. Projections based on a moving average factor from 1960 to 1978 show growing deficits in both crops. By 1985 Panama may need to import almost 33,000 tons of corn and 2,700 tons of beans. (See Exhibit B in Annex II). Other crops such as potatoes, show a similar trend. Although rice is at present in excess supply, the long-term outlook is questionable. As a result of the 1973-1979 recession, budgetary resources are strained and the assumption of increasing responsibilities for the management and control of the Canal will put additional stress on public resources. The fact that the Government's financial situation may be less secure now than it was in the past makes the outlook particularly bleak. Given the tight budgetary situation, it is questionable whether the Government can finance another costly program to artificially support domestic farm prices and subsidize large credit allocations. On the other hand, if the Government fails to take any action, it is reasonable to assume that the tight food supply situation will result in further inflation impacting most seriously, as inflation almost always does, on the rural and urban poor.

It appears then that the Government must take other, less traditional measures. More specifically, it will need to focus on increasing production efficiency. By increasing production efficiency is meant either achieving higher yields per hectare with the same input costs or achieving the same yields with lower production costs. It is reasonable to assume that if producers respond to higher prices, which evidently raise production profitability, they will similarly respond to measures to increase efficiency. The corollary of a higher output price is greater production efficiency. Other things equal, profit is increased in both instances and producer income rises.

One of the most promising means to increasing efficiency of production is through research. Research permits the more efficient utilization of resources and the substitution of less expensive production factors for more expensive ones. Through research and the resulting technical change, farming profitability can be expanded.

The process has been viewed by Janvry (ADC/RTN Airlie House Conference, January 1975) as a circular flow. (See Annex II, Exhibit C). His model demonstrates that particular interest groups, including farmers, farm suppliers, and consumers derive pay-off from greater efficiency of production (pay-off matrix). The process is conditioned by the socio-economic structure in which farmers operate. When appropriate demands are placed on the political-bureaucratic structure this structure may be able to generate technical change which, when filtered through the socio-economic structure, results in higher payoffs to the client social groups. The magnitude of the payoff is determined by:

1. The characteristics of the technical change in terms of its ability to raise yields or reduce costs;

2. The extent of the diffusion of the technology;

3. The socio-economic structure in which it will operate (which includes the availability of ancillary services); and

4. Prices which determine profitability.

Payoffs to agricultural research can be substantial. A recent summary of studies on this subject shows that internal rates of return (IRR) for some crops commonly exceed 50%. In Mexico, the IRR to wheat research has reached 90%; in Colombia it has been between 79% and 96% for soybeans. (See Annex II, Exhibit D). In only one study performed, Colombia for cotton, was the IRR found to be insignificant.

Agricultural research should be placed in the public goods category since generally benefits to society at large are greater than they are to any individual. To achieve benefits such as those above, obviously there must be a firm financial commitment by the public sector, particularly to human resources development.

Exhibit E of Annex II depicts financial commitments to agricultural research by major regions around the world. The data demonstrate that by several standards of measure, Latin America's commitment has been weak. Such indicators as expenditures as a percent of farm production, and expenditures per agricultural scientist are lower than most other major regions. To this, it might be added that Panama's commitment has been practically nil. Although the Faculty of Agronomy of the University of Panama has for several years carried out several research projects, there has been no coordinated, objective-oriented program financed by the Government. Indeed, it may be argued that one of the reasons Panamanian food production is facing a crisis today is because of this situation.

D. Background of Agricultural Research in Panama

An important impediment to expanded agricultural output and increased rural sector incomes is the low level of agricultural productivity, especially among small and medium farmers and ranchers. The GOP has recognized that the lack of applied agricultural research and the dissemination of results of this research as a principal cause of this problem.

Prior to 1975 agricultural research was carried out independently, with little or no coordination, by the Research Departments of MIDA's National Directorates of Crop and Livestock Production located in Santiago, Veragus and by the Faculty of Agronomy of the University of Panama in Panama City. MIDA's research was limited by budgetary factors. Research results were usually not published. It did, however, conduct research on a number of different crops in several different areas in Panama.

The Faculty of Agronomy had a well-trained research staff. Its research projects were methodologically more rigorously carried out but were limited to fewer geographic areas than MIDA's and were not always relevant to the needs of the agricultural sector. No research results were published on a regular basis although members of the Faculty did prepare manuscripts for extension bulletins on corn, rice, soybeans and beans in the early 1970's. While the Faculty did have a cadre of Ph.D. scientists, most of these had major teaching and/or administrative responsibilities and were able to dedicate a limited amount of time to research activities.

By 1975 the GOP recognized the need for an integrated, farmer-oriented agricultural research program which would generate significant increases in agricultural productivity. To this end the Panamanian Agricultural Research Institute (Instituto de Investigaciones Agropecuarias de Panama) was created. The Institute (IDIAP) was established with personnel from several MIDA research departments. It began with many limitations including an undertrained staff of about 30 professionals, a limited operating budget, inadequate infrastructure, and a weak organizational structure. However, it set out immediately to find solutions and ways to carry out its responsibilities and objectives. Through collaborative projects and new staff appointments, the Institute has managed to increase its professional staff by almost 50% in three years, with two additional Ph.D.'s and four additional M.Sc. level scientists, and two full-time consultants. It also has arranged for research/development training collaborative projects with CATIE, CIMMYT, CIAT, CIP, and IRDC (Canada) for key personnel.

In 1976, a team of consultants or "Working Group", partially financed by AID, prepared a comprehensive report on institutional development and established the basic concepts of a production systems area-focused approach. This report also emphasized the urgency for

an increased institutional budget, staff development, technical assistance, and stressed the need for socio-economic considerations, farmer participation throughout and the use of multi-disciplinary teams. Later reviews confirmed these needs and recommendations, and the Institute's Board of Directors took firm action in early 1978 adopting the policy to undertake an area research approach and concentrate projects in the three most populus and most important agricultural regions (Chiriquí Province, Veraguas Province, and the Azuero Peninsula which contains the two small provinces of Herrera and Los Santos and a part of Veraguas Province). Furthermore, it was decided, after additional studies and regional surveys, to select eight priority areas within those three regions to concentrate initially inter-institutional efforts in the generation and dissemination of appropriate technology for the small and medium farmer. Also, with the financial assistance from AID, along with short-term consultants from the International Agricultural Development Services (IADS), the Rockefeller Foundation, IICA and CATIE, IDIAP staff prepared in 1978 a long-range "Plan for Generating and Disseminating Appropriate Technology". (See Plan summary in Annex III, Exhibit A). This plan established more specific priorities in terms of the target group, geographic areas and commodities. In addition to establishing a long-range framework for agricultural research in Panama, it set forth IDIAP's plan of action during the next five years, described the production systems and other research activities which would take place during that period, and detailed the staff expansion, training and technical assistance needs required to implement the plan. In summary, it provided the basic foundation for the design of this project.

III. DETAILED PROJECT DESCRIPTION

A. Project Goals and Purposes

The Project goal at the level of the agricultural sector is to achieve a sustained increase in agricultural income and to improve the distribution of the benefits of the agricultural development process.

This is a major goal of the GOP for the agricultural sector and is clearly delineated in the Agricultural Development Plan, 1978-1980. Its attainment depends on the successful implementation of a series of governmental and non-governmental actions in the agricultural sector of which introduction of improved technologies at the small farm level is one.

IDIAP's program goal, i.e. its role in attaining the sector goal, is to raise small farmer productivity through the development and dissemination of agricultural technologies to Panamanian small farmer which are appropriate in terms of ecological, agronomic, socio-economic conditions which face Panama's small farm population. This goal is set forth in IDIAP's five year plan.

The project purposes are twofold. The first is the enhancement of the GOP's capability to carry out on-farm adaptive research. The second is to initiate or expand implementation of small-farmer-oriented research activities in 8 priority areas of Panama.

B. Project Strategy for the Development of Agricultural Technology

A key element in the success of this project is the introduction of a small farmer production systems research methodology designed to generate and facilitate dissemination of technological innovations and to improve farm management appropriate for Panama's small farmers and the conditions which confront them. This research strategy will include three types of production systems: (1) cropping systems; (2) mixed dairy/beef production systems; and (3) mixed cropping/livestock systems. It will involve fourteen priority commodities. This section briefly describes the general characteristics of the research methodology, the types of production systems research and the priority commodities while specific applications are described in Section III.C. Project Activities. A more detailed description of the research methodology is presented in Annex III, Exhibit B.

1. The Area-Focused Production Systems Methodology

The new methodology employs a farming production systems approach based on methodologies which are currently being employed by other Central American research Institutes, particularly CATIE and ICTA, with very promising results.

The research methodology will focus on the development of technologies which are economically as well as technically feasible at the micro (on-farm) level, and on the development on farm management practices which can best utilize these technologies. A key element of the methodology is that farmers will be directly involved in most aspects of the research process. The research will primarily be conducted on small farms in the actual environment in which the farmers operate. It will emphasize economic profitability for the farm unit.

In order to implement the new research methodology, a multidisciplinary approach involving not only plant, animal and soil scientists but also other specialties such as agricultural economics, rural sociology and communications is required. Furthermore, because climate, soil characteristics, and cultural characteristics as well as many other factors are heterogeneous, even in a country as small as Panama, an area focus is required so that research results can be validated and successfully disseminated within a relatively homogeneous setting. Therefore, a number of research teams are required.

Area-focused production systems research is a multi-phase process. The first step in the research process is area sel-

ection. This has already been accomplished for the initial phase of IDIAP's research program and eight priority geographic areas have been selected.

The second step of the research activity is that of carrying out diagnostic studies. This will involve extensive surveying and collection of other data on the characteristics of the selected areas and of on-farm conditions in those areas. The diagnostic studies will be carried out with the objective of identifying the physical, technical, economic and social conditions in which the applied research activities are to take place. Information sought will include size of farming units, prevailing farming systems and cropping patterns, biological and ecological factors, land ownership, availability and utilization of agricultural credit and/or commercially available products on inputs, investment, types of organized farming groups, management practices motivation, and market channels. Particular attention will be paid to the economic aspects of farming at the level of the small farmer. Diagnostic studies have been begun in four priority areas (Renascimiento, Los Santos, Soná and Gualaca), with participation by and technical advice from CATIE personnel.

In each area personnel will carry out an analysis of constraints and develop a research plan. Data from diagnostic studies and information obtained from the informal contacts with area farmers will be used to identify limiting factors and initial problem areas in which technological constraints amenable to applied research activities inhibit productivity. Because of limited resources only two or three research topics with the highest priority will be incorporated into the IDIAP's program in a given area at any time. These research priorities will be reviewed on an annual basis and the research plan will be maintained and/or adjusted as necessary.

The fourth step in the research process is the generation of appropriate technologies, i.e., the actual research process. This research will be conducted by multi-disciplinary research teams in crop systems, mixed beef/dairy and mixed crop/livestock systems. The general research philosophy is to build on or modify the production systems currently employed by the small farmers or ranchers rather than to attempt to introduce completely new systems. Therefore, the major portion (70-80%) of this research effort will be conducted on farms selected from the universe of small farmers in each geographic area with, of course, the agreement of the farmers who will be actively involved in the research process. Farms selected will be strategically located within the project area to maximize demonstration effects for surrounding farmers. At the same time, complementary research will be carried out on IDIAP's experimental plots located within the geographic area and in laboratories, when appropriate.

Although specific research problems are to be identified in each geographic area, general research categories include crop

associations and crop rotation with specific types of sub-projects such as genetic improvement, soil fertility and productivity plant protection, and crop management. Research at this stage, will not only adapt technologies generated in IDIAP's crop and animal research but will also test technologies already generated through the activities of other world and regional agricultural research centers such as CATIE, CIAT, CIP, CIMMYT, and ICTA. CATIE, through the ROCAP backstopped Small Farm Production Systems Project being carried out with IDIAP, will be a major source of technical assistance in this regard. Also, IICA/ROCAP's PIADIC project is expected to provide a number of area specific testable technology packages to IDIAP. Maximum utilization of these centers will reduce costs, in terms of time, money and human resources, required to develop technologies appropiate for each specific area.

Once a technology has been sufficiently developed and tested on experimental plots and on participating farmers' parcels, it must be subjected to a process of validation. At this stage a practice or practices are tested on a larger number of farmers - 20 to 30 - in each area. The validation process requires two years (in the case of crops) or more in the case of animal-related activities. During the first year the practice is introduced under close supervision and participating farmers are continually provided technical assistance. During the second year activities of the participating farmers are closely monitored to determine to what extent the practice has actually been adopted.

At this stage, special attention will be paid to studying economic benefits and in assessing comparative efficiency in land and labor utilization.

The final step in the applied research activity is the dissemination of the validated technologies. This dissemination will be achieved through the integration of technicians who serve in extension capacities into the research process. In each geographic area MIDA will assign two production agents to work with the research team on a full time basis. In addition, other professionals from different MIDA Directorates, particularly from the Directorates of Agricultural and Livestock Production and the Directorate of Social Development, as well as from the BDA will participate on the research dissemination teams in each geographic area as may be required. Furthermore, within the project areas, both the research scientists and the extension personnel will actively promote the dissemination of new or modified technologies. All members of the research teams will make contacts with target group farmers, primarily through direct farm visits and field days on farms where the validation process is occurring. A direct linkage will thus exist between the generation of appropriate agricultural technologies and their dissemination in the target areas. The incorporation of personnel from MIDA, the BDA, and other organizations on a rotating basis will facilitate a wider dissemination of research results when these individuals are reassigned

elsewhere or resume their former duties. Also, the large number of validation farms will serve to promote the technological modifications through informal communication channels. The existence of organized groups (asentamientos, juntas agrarias, and cooperatives) will facilitate dissemination through more formal channels. In addition to the direct contracts made by IDIAP technicians and production agents, mass media techniques, especially radio and the distribution of simple leaflets will be used. A significant effort will be made to strengthen MIDA/ IDIAP capabilities to produce and disseminate mass media materials.

2. Types of Production Systems Research

Research in small farmer production systems may be divided into three categories: cropping systems, mixed beef/dairy production systems, and mixed crop/livestock systems.

The cropping systems research will emphasize efficient management of production resources (including soil, water and capital goods) for existing crops combined with plant adaptation research and pest control where appropriate. This research will also focus on different types of crop associations and new crop rotations to raise on-farm net income. Specific types of interventions might include:

- modification in planting techniques,
- planting dates,
- crop density and land preparation,
- new weed and pest control methods,
- improved seed,
- new crops,
- utilization of small machinery,
- utilization of organic fertilizers,
- improved water management,
- soil conservation,
- new harvesting methods,
- better on-farm storage.

The mixed beef/dairy production systems research is designed principally to solve the production constraints of the small and medium beef/milk producers who produce 60% of the nation's milk and substantial part of the beef supply. Research has been conducted in this area by IDIAP for a number of years with CATIE assistance and it concentrates on four general areas: animal management, animal genetics, feeding and animal sanitation. Specific technological modifications might include:

- improved pastures,
- pasture rotation,
- animal health,
- controlled breeding,
- herd management,
- supplemental feeding,
- improved milking arrangements.

Mixed cropping/livestock systems research/technology transfer activities will not be undertaken initially in any priority area. However, in most areas a substantial percentage of small farmers/ranchers do engage in both livestock production and cropping activities and IDIAP's multi-disciplinary research teams will begin this type of research activity in selected priority areas once the cropping and animal production system research activities are well established. The mixed cropping/livestock activity will focus on better use of vegetative matter, improved allocation of resources between crops and livestock, and the introduction of small animal production. It is expected that, the research staff will have to have acquired a relatively high level of expertise in order to deal with the larger number of system variables which will be presented.

3. Priority Commodities

In each geographic area several (at least two or three) commodities will be targeted as priorities for initial research activities. These commodities represent the major products produced by small farmers in the area. They are identified for each area in Section III.C.2.a.

The priority commodities selected for this project also correspond with the top priority commodities of Panama's present Five-Year Plan and a more current Three-Year Plan (1978-1981). Out of the National Plan's list of most important commodities, only sugar cane and bananas are not included in the area-specific program of research and dissemination. Priority crops include rice, corn, sorghum, tomatoes, potatoes, onions, soybeans, edible legumes (including kidney beans and cow-peas) and yuca. In areas where additional crops such as yams, other vegetables, coffee, and fruit crops are potentially economically viable, they will be incorporated in the adaptive research and technology programs wherever feasible. Although such products are not "priority" commodities they will be regarded as "targets of opportunity" any time they can economically be produced by small farmers and marketed either through export or agro-industries.

Priority livestock commodities, include beef, pork, milk, poultry and eggs. In addition, as funds permit, and depending upon producer interest, some attention may be given to other small-animal production such as ducks and rabbits.

The major justification for the selection of these 14 top priority commodities is that they comprise the basic food crops of both the rural and urban sectors. Also they are (with the exception of soybeans) the major commodities produced and consumed by small farmers.

C. Project Activities

1. Introduction

Two types of activities are contemplated in the project. These are technology development and dissemination and the institutional strengthening of IDIAP. Technology development activities are sub-divided into area-focused production systems research and complementary research activities. The production systems research activity to be implemented in three Provinces is the project's most important activity and will be carried out in eight priority geographic areas. Complementary research components include activities (integrated pest management and research contracts) which are supportive of, but not directly a part of IDIAP's area focused research. Research activities constitute expenditures directly related to 70% of the project budget.

Institutional strengthening or development includes the staff expansion, staff training, and construction and equipping of the central headquarters and regional support facilities. These specific activities are essential for the long-term viability of IDIAP but also support the area focused research activities. Institutional development activities account for 30% of the total project budget.

A summary financial plan is presented below.

Agricultural Technology Development
Overall Financial Plan
(US $000)

Component	AID/DL	AID/DG	GOP	TOTAL
I. Area Focused Research				
A. Construction	$ 451		$ 360	$ 811
B. Equipment & Materials				
1. Field Equipment	418		50	468
2. Research Inputs	592		276	868
3. Seed Processing	198			198
4. Laboratory	32			32
5. I, E & C	100		40	140
6. Office Equipment and Furniture	20			20
7. Workshop	51			51
C. Vehicles	422		213	635
D. Technical Assistance	210	$1,000		1,210
E. Training	0		0	0
F. Operational Costs				
1. Salaries, IDIAP			3,584	3,584
2. Fuel, Maintenance			500	500
3. Salaries, MIDA			592	592
G. Complementary Research Activities	500			500
Sub-Total	$2,994	$1,000	$5,615	$9,609
II. Institutional Development				
A. Construction	$ 883		$ 890	$1,773
B. Equipment & Materials				
Laboratory	200			200
I, E and C	82			82
Office Equipment and Furniture	191		118	309
C. Vehicles			47	47
D. Technical Assistance	300			300
E. Training	1,350		100	1,450
F. Operational Costs				
1. Salaries, IDIAP			160	160
2. Fuel, Maintenance			70	70
Sub-Total	$3,006		$1,385	$4,391
Grand Total	$6,000	$1,000	$7,000	$14,000

2. Research Activities

a. Area Focused Research Activities

(1) Summary Target Group Description

IDIAP's major research effort will be the implementation of area focused production systems technology development activities in eight priority geographic areas of Panama. Specifically, IDIAP will implement cropping, animal production and/or mixed cropping/livestock systems research activities in these areas according to the research methodology described in Section III.B. and Annex III, Exhibit B.

The two provinces of Chiriqui and Veraguas, where all but one of the priority areas are located, have been identified as the two most important agricultural regions with highest concentration of subsistence, small and medium farmers and organized farming groups, and with good potential for increased land and labor productivity and other improvements. (Specific criteria for selection of these areas are discussed in Annex III, Exhibit B. These criteria will also be used in selection of future geographic areas or in the event that more detailed data from diagnostic studies suggests that a production systems research program would not be viable in a selected area.)

By working in the eight priority areas IDIAP research will reach a target group which consists of approximately 25% of Panamanian farmers.

The eight project areas, which have been identified in IDIAP's medium term plan, and the priority commodities which will be studies in each area are:

(a) Soná District, Veraguas (corn, rice, yucca, cattle).

(b) Montijo District, Veraguas Province (rice, corn, livestock, yucca).

(c) Parts of the Santiago, La Mesa, Cañazas and Santiago Districts, Veraguas Province (corn, livestock, yucca, vegetables).

(d) Los Santos District, Los Santos Province (livestock, yucca, tomatoes, corn, onions, sorghum).

(e) Renacimiento District, Chiriquí Province (corn, beans, cattle).

(f) Baru District, Chiriqui Province (rice, corn, sorghum, beans, cattle).

(g) Bugaba District, Chiriqui Province (potatoes, tomatoes, onions, other vegetables).

(h) Gualaca District, Chiriqui Province (cattle, corn, rice).

The target group includes more than 22,000 farm families in the eight project areas. Table 2 presents the number of farms and the target population in each of the eight areas. Table 3 contains a breakdown of the total farms in the project area by size and shows that 65% of the farms are less than 10 hectares. Furthermore, a large percentage of units over 10 hectares, e.g., in Gualaca, Santiago, Soná and Montijo, are in extensive livestock operations on poor, unimproved land.

TABLE 2

POPULATION, NUMBER OF FARMS AND AREA UTILIZED, TOTAL PROJECT ARE BY PROVINCE AND DISTRICT

	Population	Number of Farms in Projected Area	Area (ha.)
Chiriqui Province			
1. Renacimiento	8,049	1,351	41,038
2. Baru	40,367	2,966	61,880
3. Bugaba	39,466	5,550	73,692
4. Gualaca	6,482	1,002	42,583
Veraguas Prov.			
5. Soná	19,372	3,117	93,470
6. Montijo	9.414	2,813	100,429
7a. Santiago (Part)*	6,202	1,214	9,068
b. San Francisco (Part)*	1,496	311	4,621
c. La Mesa (Part)*	5,686	1,026	10,218
d. Las Cañazas (Part)*	2,630	510	5,607
Los Santos Province			
8. Los Santos	16,692	2,292	30,913
Total	155,856	22,152	473,519

* Includes only the part of each of these District which is included in th Project Area.

More detailed descriptions of the target group farmers are contained in Annex III, Exhibit C, Descriptions of the Eight Project Areas, and Annex V, Social Soundness Analysis.

TABLE 3

AREA AND NUMBER OF FARMS ACCORDING TO SIZE, TOTAL PROJECT AREA

Size (Hectares)	No. of Farms	Percent	Area (Hectares)	Percent
Less than 0.5	3,471	15.67	390	.08
0.5 to 4.9	8,151	36.79	14,170	2.99
5.0 to 9.9	2,691	12.15	16,819	3.55
10.0 to 49.9	5,722	26.0	179,840	37.98
50 or more	2,117	9.4	262,300	55.39
TOTALS	22,152	100.0	473,519	100.0

(2) Outputs of Area Focused Production Systems

Outputs of the area focused production systems research will be obtained by implementing the methodology described in Section III.B. in the eight priority areas. The specific outputs of the area focused research activities include ten diagnostic studies, at least 1,260 field experiments (including replications); and, most importantly, at least 60 recommended new or modified production practices (7 or 8 per area) which will be disseminated to and, it is anticipated, fully adopted by at least 30% of the farmers in the target areas and partially adopted by many of the remaining farmers.

The ten diagnostic studies, which represent the first step in the implementation of the area focused production-systems research methodology will be completed in the eight priority areas and in at least two additional areas. Execution of diagnostic studies in the latter areas will allow IDIAP to quickly expand the geographic scope of its research activities when it has the trained manpower and other necessary resources to do so.

The 1,260 field experiments represent discrete components of the area-focused research activities which will be terminated or in progress at the end of five years. These experiments, examples of which are presented in Section III.B.2., may be completed in one or two cropping cycles or, in the case of some animal production systems experiments, they may be carried out over several years. Most of these experiments will involve a number of replications. A

relatively greater number of cropping systems experiments will be conducted than will animal production systems and mixed cropping/ livestock systems.

Based on the results of the field trials, a number of modified technologies will be subjected to the validation on a large number of farming units in each area. These technologies which are successfully validated in a project area can be widely disseminated in that area. Because the agricultural research/validation/technology transfer process necessarily requires several years to accomplish, particularly in the case of animal production systems, and because termination of AID's participation will not constitute the end of the project,* the project will continue for at least an additional five years. By the end of ten years, at least seven or eight innovations will have been recommended for each area (on the average), although in fact, IDIAP researchers expect to be able to recommend more innovations in most areas.

(3) Inputs Required for Area Focused Production Systems Research

Inputs required to achieve output targets are presented on an aggregate basis for the eight geographic areas. Although there will be some variation of input requirements among areas, depending on such factors as area size, cropping and animal production patterns, the variation among areas is not great enough to justify an area by area breakout of input requirements.

(a) Construction

Inputs include $811,000 for the construction of area facilities (denominated as sub-centers), as well as regional support and seed processing facilities. The loan will provide $451,000 while the GOP counterpart contribution amounts to $360,000.

The area sub-centers are small, functional buildings which contain a small one-room office,

* For purposes of project accounting the seven million GOP counterpart will be disbursed over five years. It does not include the amount for the last five years of the project which is discussed in the Financial Plan, Section V.

provide storage space for materials and equipment required to conduct experiments, and have a small dormitory so that technicians may stay overnight within the project area. They will be built in Renacimiento, Barú, Montijo, Los Santos, Soná, and Calabacito (Santiago). Two other centers in Bayano and Bocas del Toro will be built with counterpart funds.

The following construction activities will also be undertaken:

- Expansion of presently limited conference space, offices, laboratories, utility, storage/service buildings at these facilities is also needed.

- Construction of foundation (basic and registered seed) seed processing and storage units at the Alanje in Chiriquí Province.

- Expansion of the potato (and other vegetable) seed processing and storage facilities at the Cerro Punta sub-center (Chiriquí Province).

Detailed construction cost estimates are provided in Annex VIII, Exhibit D.

(b) Equipment and Materials

Equipment and materials requirement consist of field equipment, research inputs, seed processing equipment, workshop equipment, and small amounts of laboratory and office equipment. Field equipment and tools will be required for research activities both for experimental plots and for on-farm research.

IDIAP's field equipment needs for the area focused program include 20-40 h.p. and 50-70 h.p. tractors with full sets of implements as well as miscellanoeus field equipment, hand tools, portable testing kits and instruments. The major part of this equipment will be located at sub-centers in or near the eight priority areas. Total cost of field equipment is $468,000 of which $418,000 will be financed from loan funds and the remaining $50,000 from counterpart funds.

Research inputs include items such as fertilizers, pesticides, seed, breeding stock, fencing and unskilled labor which are required to actually carry out research experiments. The nature of the experimentation will vary greatly; however, IDIAP has estimated an average cost of $270 per experiment in the cropping systems activity. For animal

production system experimentation, the cost of establishing and carrying out research activities amount to $40,000 in each area. Area diagnostic studies for 10 areas are budgeted at $100,000, including replication of the studies for evaluative purposes after five years. Total requirements for research inputs over a five year period, including contingencies, are estimated to be $868,000 of which the loan will finance $592,000 and $276,000 will be provided through counterpart funds.

The seed processing and storage equipment is an important factor in both IDIAP's proposed area-focused research program and its longer term institutional development. It will facilitate processing of basic, foundation, research and demonstration seed. The seed processing and storage equipment provides IDIAP with the opportunity to develop and/or introduce new seed varieties under conditions which will result in high germination rates and low content of other seed and extraneous matter - a capability which it does not now have. It not only fulfills IDIAP's requirements for the area-focused research activities but will play a key role in the success of IDIAP over the long term by allowing it to initially disseminate new or modified seed varieties to the National Seed Enterprise and to commercial producers. Total cost of the seed processing and storage equipment is $198,000 to be financed with loan funds.

Approximately $100,000 of loan funds and $40,000 of counterpart funds will be allocated to the purchase of equipment and materials for the development, production and dissemination of information about technologies developed under the project.

A small amount of workshop equipment, $51,000, will also be required for the area-focused research activity. This equipment is required for minor repairs to vehicles and agricultural equipment located in the project areas. Minimal laboratory and office equipment, amounting to $32,000 and $20,000, respectively, will be provided for the area sub-centers. This equipment will be financed from loan funds.

Total equipment and material needs in the area-focused research activity amount to $1,411,000 of loan funds and $366,000 of GOP counterpart. A detailed equipment list is presented in Annex VIII, Exhibit B.

(c) Vehicles

A substantial amount of funds will be invested in vehicles (19 pick-ups, 21 utility vehicles, 6 mini-buses and 3 trucks) to provide adequate transportation of

personnel and supplies in the eight project areas. Investment in vehicles is critical to project success as the lack of mobility of research/technology transfer staff has been identified as a potential major constraint in the successful dissemination of appropriate technologies through direct contact with target group members. At least 5 vehicles will be available in each research area for use by the field research and multi-disciplinary teams and support staff. IDIAP's area team coordinator, will, in each case, assign vehicles as needed to team members and field staff. All participating technicians, including those from other agricultural sector institutions, will have access to the vehicles.

Total cost for the pick-ups, utility vehicles, mini-buses and trucks required for the area-focused activities will be approximately $422,000. In addition, IDIAP will purchase vehicles valued at $213,000 for the use of a number of its staff, including consultants and multi-disciplinary team members, from counterpart funds.

(d) Technical Assistance

An integral element of the area-focused research is technical assistance. The success of IDIAP's applied research program depends, to a large degree, on a strong technical staff to implement the planned components of the project. Because IDIAP, especially during the first years of the project, will not have an adequate number of well-trained and experienced staff to fill all the positions, the Institute will relay on foreign professionals provided under this and other projects to provide needed expertise for program implementation.

A basic precept in this project is that all of the foreign specialists, with the exception of some short-term consultants on special projects, will be participating line staff members of the Institute's programs, fully integrated into the research and technology transfer activities, inter-disciplinary teams, and action committees. It is strongly felt that this approach will significantly enhance the project's success, and that the specialists, instead of acting in only an advisory capacity, will be able to contribute much more to the national program for generating and disseminating appropriate technology. Key determinants in the type and amount of technical assistance are those provided in "bottleneck" areas where IDIAP is most deficient in trained personnel, e.g., agricultural engineering, agricultural economics, animal sciences research

management and communications/dissemination. As described further in the scope of work for each long-term specialist (see Annex VII, Exhibit D), most of these positions will require highly-qualified professionals with broad academic training and field experience. It is indispensable that specialists under this project be proficient in Spanish, and this criterion will be followed except in very special cases when a qualified consultant fluent in Spanish cannot be obtained. The technical assistance will be planned so that it not only logically fits in the requirements of the process but that it replaces more senior IDIAP personnel who are in long-term training.

The total amount of technical collaboration time for the six long-term and the various short-term professionals required in this project equals 220 person-months. The major portion of the time of these specialists will be spent in area research-related activities.

It is estimated that 147 person-months of long-term technical assistance, costed at $6,800 per person-month, and 29 person-months of short-term technical assistance costed at $7,200 per person-month will be dedicated to area focused research activities. The total cost for the area research related, technical assistance would be $1,210,000. Of this amount $1,000,000 will be grant funded and will be limited to technical assistance provided by Geographic Code 000 (U.S.) firms or individuals. The remainder may be used to finance technical assistance from Latin American sources as well as Panama and the U.S. Special efforts will be made to contract services from the international and regional research centers such as CATIE, CIA, CIP and CYMMYT.

(e) Training

Training, although wholly allocated to the institutional development activity, will contribute significantly to the implementation of the area-focused research program. Both field research and multi-disciplinary personnel will receive short term training. Also, as IDIAP scientists complete their long-term training they will be incorporated into the professional support staff. Training requirements are specified more fully in Section III.C.3.b.

(f) Operating Expenses

The large input into the research process, in terms of its monetary value, is the contribution of staff time of IDIAP and other agricultural sector personnel to the production systems research and dissemination activity.

Approximately 80% of IDIAP's counterpart contribution for personnel costs may be allocated directly to the area-focused research/dissemination activity. This amounts to approximately 426 person-years (including professional, technical and support personnel) valued at a total of $3.6 million. These include two or three IDIAP staff members assigned to each of the eight area field research teams between 5 and 9 research scientists on each of three multi-disciplinary teams and a significant percentage of the time for research support personnel at the Santiago headquarters and regional offices.

In addition, 74 person-years valued at $592,000 will be contributed by MIDA which will contribute the services of at least two production agents in each of the eight areas. These technicians will be permanent members of the area field research teams. Their primary functions will be to work with area farmers at the validation stage and to disseminate the technical recommendations which are developed. In addition, fuel and maintenance costs for vehicles and field equipment are estimated to be $500,000.

b. Complementary Research/Dissemination Activities

IDIAP has identified several types of research activities which are complementary to its area-focused program. These are Integrated Pest Management and Applied Agricultural Research Activities for which other public or private institutions or individuals would have the competence and experience to undertake a portion of the investigation. $500,000 will be specifically set aside to finance these programs.

(1) Integrated Pest Management Program

The development of an Integrated Pest Management (IPM) Program represents one of IDIAP's major activities over the long term. Because of its importance and its nation-wide applicability it has been identified as an activity separate from the area-focused research program.

Although constituted as a separate program because of its importance, IDIAP's IPM program will be closely linked with and integrated into the area research effort. The IPM program will focus on verification, identification of possible biological pest controls, improved overall farm management practices and dissemination of information about integrated pest management practices to producers.

Currently, appropriate pesticide management information is not widely available in Panama. Many producers have little knowledge of minimum effective applications and related safety problems of pesticides. Panama imports an estimated 50,000 kilograms of dry agricultural chemicals and 500,000 liters of agricultural chemicals annually, while the majority of these chemicals are utlized by large commercial and governmental farming organizations, small and medium producers also apply them with increasing frequency. Furthermore, the Agricultural Sector Three-Year Development Plan, 1978-1980, projects an extremely rapid eight-fold increase in the value of imported chemicals through 1985. Consequently, the development of an Integrated Pest Management Program has become one of IDIAP's key concerns.

IDIAP has already begun working with BDA and MIDA production agents to provide IPM information where needed. Several Government of Panama agencies have already recognized the need and potential benefits from an integrated pest management program. Among these, is the Agricultural Development Bank (BDA) which has already carried out some IPM training for its field staff in contact with farmer applicators. Also there is an active IPM program underway in Bayano (state land) involving 2,000 hectares of rice. The Ph.D. entomologist who will head IDIAP's IPM research effort has been trained in IPM at the University of Florida and has a sound conception of what must be done and is capable, with some short-term technical assistance, of developing an IPM program for Panama. He has collected 60 speciments of potential beneficial parasites as well as a large number of plant pathogens and has sent them to the University of Florida for identification. He is also responsible for approving (or disapproving) all imports of pesticides into Panama.

The IPM program will include a number of specific outputs.

Near term outputs include:

(a) Data Collection and analysis -- more accurate data about the present extent of pest problems and pesticide usage by small farmers will be gathered as part of the base line information gathered in the diagnostic studies in the eight areas. This will serve as the basis for analyzing the types and seriousness of pest problems and for planning educational program designed specifically for small farmers.

(b) IPM Material Adaptation -- Integrated Pest Management educational materials developed by the University of Florida and provided to the IDIAP entomologist will be

analyzed for their possible adaptation and dissemination in Panama. This package of materials includes an IPM primer designed to explain basic concepts in a simple form to farmers and to agricultural technicians and professionals, as well as a sound-slide package dealing with pesticide usage.

(c) IPM Plan -- IDIAP will develop a national plan for IPM implementation in coordination with other agencies. (The proposed IPM specialist to be located in the Organismo Internacional Regional de Sanidad Agropecuaria (OIRSA) will provide assistance to this program).

Medium-term outputs will include:

(a) Establishment of a biological control laboratory to study and reproduce beneficial natural parasites for release on a regional scale. This laboratory facility will be included within the multi-purpose laboratory complex which will be built in IDIAP's Santiago headquarters center.

(b) Implementation of an IPM educational program aimed at all private and public sector specialists involved in pesticide sales and application. This educational program will also include a specific component directed at small farmers in the eight priority geographic areas.

Funds amounting to $100,000 will be used to acquire specialized equipment for the biological control-pesticide analysis laboratory and to carry out the educational programs, including the adaptation of existing IPM materials to Panamanian conditions and the dissemination of these materials. Also, short-term technical assistance and training in IPM and provision of standard laboratory equipment and physical facilities are included in various line items of the institutional development component of the project.

(2) Research Contracts

Because there are a number of research topics which are not directly related to IDIAP's areas of competence but which are of potential importance for alleviating constraints on the development of Panamanian small-holder agriculture, a research contract fund will be established. Contracts will be awarded for studies, experimental research and pilot activities which are necessary or which will greatly enhance the results of the production systems research program. Examples of research projects which IDIAP is considering contracting include special studies

on subjects such as small farmer credit utilization, post harvest crop losses, inventories of agricultural implements utilized by Panamanian small farmers, impacts of government pricing policies on small farm production, specialized surveys of project areas (in addition to the diagnostic studies undertaken by IDIAP) as well as for experimental research and/or pilot projects in areas such as farm energy utilization (e.g. windmills, micro-hydres, solar grain drying), methods for preserving and storing vegetable and animal products, the utilization of leuecaena as a forage crop in Panama and the introduction and adaptation of crop and animal species not indigenous to Panama. The primary potential contractors would be Panamanian private and public sector institutions including the University of Panama, in particular the Facultad de Agronomia, the National Agricultural Institute, the Santa Maria la Antigua University, the electricity institute (IRHE) and possibly private farmers/ranchers. Secondary potential contractors would include international and regional research institutes.

Specific selection criteria for activities to be contracted by IDIAP are that they clearly contribute to the success of the small farmer production systems research program and that they are activities which IDIAP is unable to undertake because of a lack of specialized personnel available to carry out the activities.

It is expected that up to 20 research contracts will be issued during the life of the project, while funding requirements for each contract will vary significantly according to the nature of the contract, average amount of $20,000 per contract is projected. The contracts would pay for necessary research equipment and materials, honoraria for the investigators, when appropriate, and other expenses incurred, including the publication of research results. Loan funds amounting to $400,000 will be set aside for this activity.

3. Institutional Development

Raising levels of agricultural productivity through applied agricultural research is necessarily a long-term endeavor. In order to achieve the project purpose of enhancing IDIAP's capability to carry out agricultural research on a long-range continuing basis, the following institutional development outputs are required:

(1) An expanded research staff of sufficient size to carry out a large scale research program;

(2) An adequately trained professional research staff capable of implementing an area-focused production systems research program; and

(3) An adequately equipped central headquarters facility operating in Santiago.

To obtain these outputs substantial resources are being channelled toward staff expansion and development, including the strengthening of IDIAP's research management capability and other types of institution-building activities including the expansion of IDIAP's physical plant, the purchase of vital laboratory equipment, and the provision of technical assistance. Activities not directly allocable to the area-focused production systems component of the project, or which are necessary for IDIAP's long-term development, are discussed under the institutional development component of the loan, even though in many cases, e.g., such as training and staff expansion, they may be necessary elements in the successful implementation of the priority area project activities.

a. Staff Expansion

IDIAP's professional staff consists of 45 professionals of whom 3 have PH.D.'s; 11 have M.S. degrees; 21 are Ingenieros Agrónomos and 9 have other university degrees. In addition, IDIAP has 29 agrónomos who have three years of agricultural vocational education and from 2 to 15 years of experience.

IDIAP has already embarked on a reorganization of staff assignments to better utilize its existing staff and to implement the area-focused research methodology, including technology transfer activities. (See Annex VII, Exhibit F, 1979-IDIAP Staffing Plan). While this reorganization has resulted in a more efficient use of IDIAP's current human resource base, a substantial increase in professional and sub-professional personnel is planned. IDIAP has programmed an expansion of its professional and technical staff from 45 to 95 during the five year life of the project. The magnitude of this expansion is ambitious. However, with a continued commitment by the GOP to agricultural research and effective planning by IDIAP the staff expansion can be completed within five years. The GOP commitment to increase IDIAP's staff and to maintain, within the limits placed on public sector resources, a relative high salary scale is reflected in the increase in IDIAP's operating

budget of almost 100% for FY 1979. The GOP commitment to an expanded agricultural research program is further discussed in Section IV.D., Administrative Feasibility.

Institutional incentives to help assure a high degree of staff permanence and performance, and to attract additional staff includes:

(1) Comparatively high salary scales, especially at the professional level;

(2) Staff prerequisites including; (a) a vehicle plan whereby the Institute purchases a staff vehicle for official and personal use, and at the end of the three-year period, the staff member, who is responsible for all maintenance and operating costs, obtains title to the vehicle; (b) a family insurance plan; and (c) excellent opportunities for professionals to continue with advanced studies and specialized international training.

All additional salary costs incurred as a result of staff expansion will be financed through GOP counterpart contributions. Budgetary implications of the staff expansion are examined in Section V.C. of the FInancial Plan.

b. Staff Development

The general philosophy of the staff development program is to provide specialized short and long-term training to existing and future staff members that will better equip them to fill the various positions required to implement IDIAP's new research methodology.

The staff development program has been designed to accomplish the following objectives:

(1) Short-term objectives. 2-5 years.

(a) To provide IDIAP with technical personnel who are totally conversant with the technology accumulated in the regional and international research centers such as CIMMYT, CIAT, CIP and CATIE.

(b) To make maximum use of IDIAP's existing technical personnel by providing the opportunity to move into responsible research roles through improvement of their technical capability.

(c) To prepare IDIAP personnel to assume managerial roles in putting together all available technology,

generating new technology, and testing appropriate production systems and practices for the eight priority areas.

The above objectives will be realized mainly by efficiently using the in-depth short course training offered by the International Centers. Such courses are normally of 3-6 months duration, are non-degree oriented and are designed to give the scientist a good working knowledge of the technology available and of the procedures for adapting it to specific agro-ecological conditions.

Institutions such as CIAT, CATIE (in addition to the training of IDIAP personnel as part of the Small Farm Production Systems Project), and CIMMYT, will play major roles in the provision of short-term training. Scientists who complete such courses will become top technologists in Panama in their respective areas of expertise. They will be better able to initiate and maintain the system of field-scale test demonstrations of known technologies, identifying deficiencies in available information which require further research, and arrange for in-country training of transfer of technology agents for MIDA and other organizations in areas related to their specialized knowledge.

(2) Long Term objective (4-10 years).

To build a staff of scientists who have the ability to identify Panama's priority agricultural research problems and who can utilize relevant scientific knowledge and existing resources to resolve them.

To fulfill this objective will require a substantial increase in the number of researchers with post-graduate degrees. IDIAP has analyzed its long term training needs and has developed a Staff Training Plan, which contemplates training to the M.S. level for 25 staff members and to the PH.D. level for 10 additional staff members. Generally training for advanced degrees will be provided to the more senior staff. Long-term training will be provided in fields where IDIAP personnel currently lack sufficient expertise but which are necessary to implement the new research methodology. The major focus of the long-term training program is in agricultural economics, communications, farm management, soil productivity, and crop and animal sciences. Annex VII, Exhibit B, contains a listing of types of training required for IDIAP to achieve staff development objectives.

The estimated training time for all staff listed during the five-year period totals 1,450 person-months. Although

some of the short-term training will be carried out at considerably reduced cost in collaboration with some of the international agricultural research/development institutions, it is estimated that an average cost per month (including travel and incidental expenses) of $1,000 will be required. Therefore, the total costs would be $1,450,000 of which $1,350,000 will be financed from loan funds and $100,000 from GOP counterpart funds. Of the total available for expenditures on training, approximately $500,000 will be allocated for short-term training and observation tours both in Panama and in other Latin American countries, for IDIAP's administrative and technical personnel. The Masters level training will take place primarily on Latin American Universities, national and international research/development agricultural institutes, while training to the Ph.D. level and some of the M.S. and specialized training will take place in the U.S.

c. Technical Assistance Requirements

The major part of the technical assistance will be utilized in project area research activities. However, the overall impact of technical assistance in the institutional development process will be significantly greater than the allocated number of person-months because of the demonstration effects on IDIAP's technical and professional personnel which will result from working together with experienced research scientists. The guidance provided by the technical experts in a context in which IDIAP personnel are learning by doing will have marked and long-lasting positive effects on IDIAP's performance as a research institution. Approximately 42 person-months of technical assistance which will be devoted to long-term planning, presentation of short courses and other activities are specifically included under the institutional development component since they contribute more to, the longer term development of IDIAP rather than to specific short or medium term research objectives. A total of $300,000 of loan funds have been allocated for technical assistance under the institutional development portion of the budget.

d. Construction of Facilities

IDIAP currently operates in a very cramped and ill-suited headquarters facility in Santiago, Veraguas. Only a small amount of space is available for offices and laboratory facilities. As many as six staff members are crowded into each small office located in the MIDA headquarters. Also, there are no or inadequate green-houses, seed storage rooms, and information

service facilities. These deficiencies are a major constraint to the efficient administration and implementation of IDIAP's research activities. Therefore, the project will finance a new headquarters building in Santiago specifically designed to fulfill IDIAP's needs as an agricultural research institute.

The new headquarters will be located in Santiago because of its central location and the need for close collaboration with MIDA. It will provide office space for the director and administrative personnel as well as for technical activities. Space will be provided for an information services and documentation center, for data processing, for seed processing and storage, for general services, for meetings and conferences and for equipment and vehicle repair facilities. In addition, a multi-purpose laboratory facility for seed testing, soil and plant material analysis, entomology research and other related research will be provided.

Loan funds amounting to $883,000 will be used for the construction of this facility which will have a functional, conservative, no-frill design while GOP counterpart funds amounting to $890,000 will cover Architects and Engineering fees, site development, installation of utilities, interior finishing, including built-in furniture and light fixtures, as well as contingencies. Detailed construction cost estimates are presented in Annex VIII, Exhibit A, while preliminary plans are contained in Annex IX.

e. Equipment

The facilities to be constructed at Santiago will be equipped and furnished with project funds. Equipment will include laboratory equipment, seed processing and storage equipment for the communication and information services center in addition to office and staff equipment and furniture. Plant analysis equipment, minimal soils testing equipment and general laboratory equipment will be provided for the headquarters facility in Santiago. Laboratory equipment also includes equipment for the animal production systems program which will be located at Gualaca. The major portion of this equipment will be used to analyze the nutrient content of pasture grasses. The total estimated cost for laboratory equipment is $200,000 to be financed with loan funds.

Equipment for the communications and documentation center, including photographic equipment, offset duplicating machines, electric stenciling machines, recording equipment, as well as projectors and other visual aids, will be obtained. This equipment, together with training of IDIAP personnel in communications, will allow the institution to develop a capacity

to produce a large volume of simple single-concept written and visual aids to be used by field research/technology transfer personnel in the dissemination of appropriate technological practices. Staffing, equipment and materials requirements will be related to the specific program needs at the field level and a substantial portion of the cost of this activity is allocated to the area research budget. However, $82,000 of loan funds, for equipment to be located at the National headquarters, are allocated to the institutional development activity.

Office and staff equipment needs include purchase of a new mini-computer and other data processing equipment, radio communications equipment, photocopying machines and a number of calculators in addition to more standard office equipment such as typewriters, furniture and air conditioning. Office furniture and equipment will be acquired through the excess property program (Section 607) where feasible. A total of $309,000 is budgeted for office equipment and furniture of which $191,000 will be loan funds and $118,000 will be counterpart funds.

The value of equipment and furnishing procured under the institutional development component of the project amounts to $591,000 of which $473,000 will be procured with loan funds and $118,000 with counterpart funds.

IV. PROJECT ANALYSES

A. Economic Analysis

1. Benefits expected from the Project

An increase in net farm income per hectare will be the most direct, major and most easily verifiable result of the application of improved agricultural technologies and improved management techniques. The primary source of this net income increase will be increased yields per hectare. It is also anticipated that reduced input costs with no change in yields will be a factor leading to the increase in income. In some instances, there will be both effects working in combination.

Indirect benefits, that may be as important as the direct increase in income per hectare benefit, are expected to include: reduced soil erosion, increased demand for off-farm labor, foreign exchange savings/earnings, and reduced post-production losses.

Panama currently suffers from rather low productivity for most major crops. The substantial difference between present Panamanian yields and those elsewhere in Central America is an indication that development of applied agricultural technology might have a dramatic impact in Panama. This potential provided the initial basis for concluding that an applied agricultural research project in Panama could prove to be feasible.

2. Results of Feasibility Analysis

To test the economic feasibility of the project a composite crop and a composite livestock farm were developed, using available farm budget data from two of the areas to be included under the project, Renacimiento District (for crops) and Los Santos District (for cattle). With project and without project farm budgets were developed in order to obtain the change in income resulting from the projected adoption of a minimum amount of new technologies for the two farms. The farm budgets and details of the improved technologies can be found in Annex IV. The improved technologies are assumed to be slowly introduced over approximately ten years generally beginning with simple improvements in cultural practices and then graduating to more complex ones. For the crop farms the improved techniques are assumed to include the following items: improved weed control, improved seeds, mixed fertilizers, improved spacing, use of urea, chemical weed control, and introduction of fungicides

and pesticides. For the livestock farms the improvements include: mineral mixture supplementation, planting of King and Pangola grasses, low level fertilization of "Faragua" pasture, improved rotation of pasture, replacement of "Faragua" grass with improved pasture grass, and an increase in the role of supplemental feeding.

After ten years of gradual introduction, these modest technological improvements are estimated to result in a total increase in annual income of $1818 per crop farm and $3,215 per livestock farm over baseline incomes at the start of the project. That is, from approximately the tenth year on, net annual crop farm income will be $1818 higher, and livestock farm net annual income will be $3,215 higher, than it would have been without the project. For crop farms this represents a 140% income change, and for livestock farms, a 180% change. The income changes for these two composite farms are assumed to be representative, on the average, of the technology adopters from among the estimated 22,000 farms in the project's eight regions. It is estimated that 30% of both types of farms will adopt all of the technologies offered, and a large number of the remaining 70% will adopt some of the technologies. In order to capture an estimate of the benefits from partial adopters in the Benefit/Cost analysis, it is assumed that they are equivalent to 10 "full-adopters".

In conducting the benefit-cost analysis under this first procedure, the following major assumptions were made: (1) the income changes from the composite farms are representative, on the average, of the changes expected to occur throughout all eight regions; (2) an "equivalent" 40% of both types of farm will be full-adopters; (3) technical assistance can be made available to only one-third of the full-adopters at any one time so that the gradual income changes over time occur on a staggered three year basis; (4) a 15 year period for measuring project benefits and costs, and (5) a 15% opportunity cost of capital. Based on these assumptions the benefit-cost ratio for the project is 3.2 (3.0 for crop farms and 3.7 for livestock farms). If the indirect benefits mentioned earlier could be quantified, the results would be even greater.

B. Social Cultural Feasibility

The discussion of the project target group presented in Section III.C.2. and in the Social Soundness Analysis (Annex V) identified three groups of farmers (small farmers, farmer/ranchers, group farmers) as the primary direct beneficiaries. This section presents the conclusions of the social soundness analysis with regard to the socio-cultural feasibility of project activities.

The general approach in the design of project activities has been to develop technical courses of action which fit as well as possible with existing socio-cultural patterns. Basic research carried out on centralized research stations most often never reaches or benefits small farmers in developing countries. Rather than promote this kind of research, an applied research approach will be utilized. This method, which takes already existing technologies from similar geoclimatic areas, with similar agricultural systems (crops, livestock, mixture), verifies their feasibility under local research station conditions and carry out on farm experiments with cooperating farmers to demonstrate their agronomic and economic feasibility, minimizes the number of potential social-cultural constraints which could limit achievement of the project's purpose. This type of research, which leads to the introduction of simple technological changes including improved farm management techniques, should be seen by farmers as being low or no risk changes which are within the realm of their financial capabilities and which result in substantial increases in production or a reduction in input costs.

The project takes into account the following potential socio-cultural constraints which it must deal with successfully to accomplish its goals:

1) Farmer/Researcher Communication

The traditional problem of how to make research relevant to the farmer's problems is one of communication. When there is a constant interchange or dialogue between the farmer and the researcher, production constraints are generally resolved by means of appropriate and timely applied research. This applied agricultural research project is set up specifically to resolve this major constraint by getting the farmer, the dissemination agent and the researcher to work together as a team in the farmers fields, on his specific problems to come up with simple, practical, economic solutions to the most pressing production constraints. Previous experience has shown farmers more than willing to participate in this sort of research. In many instances farmer requests for such assistance have gone unattended for lack of personnel.

2) Risk Aversion

The traditional farmer has learned through a lifetime of experience just exactly what and how he needs to plant his crops in order to produce enough to survive. Any deviation from his time proven methods constitutes a risk. The bigger the change, the greater the risk and the greater the likelihood that the farmer will not take it. However, if it can be demonstrated that some new practice is feasible for the farmer to do on his own land given his resources, he is likely to try it especially if it can be shown to substantially increase his yields or decrease labor or other inputs. An important part of the project methodology deals with these constraints by proposing changes which involve the least risk first as well as carrying out area specific research combined with a validation process in which profitability is a paramount consideration. Moreover, for the limited number of selected farms participating at the technology generation and validation stages, IDIAP will provide, at no cost, most inputs necessary to carry out the field trials. The innovative farmers participating at these stages of research will incur virtually no additional cash outlay. It is believed and evidence from both Bugaba and Renacimiento indicate that once the field trial is demonstrated to be both technically feasible and financially profitable, this will be sufficient to induce the farmer to adopt the technology at his own risk.

3) Tenure Considerations

The majority of land held by the target group is not legally titled but held by Derechos Posesorios (Usufruct Rights). Usufruct rights, which are established by the person who first clears and cultivates land in the public domain, are recognized by the Panamanian legal system. These rights are recognized by the official Agricultural Bank of Panama and are sufficient for obtaining credit. Also the incidence of renting and share cropping of land in Panama is extremely minor, and this will severely limit the possibility that project benefits would be captured by absentee landholders. Therefore, it would appear that problems related to tenure considerations will be minimal.

C. Technical Analysis

This section summarizes the results of a number of analyses which have been carried out for IDIAP by expert consultants during the past three years. The rationale for the use of the production systems methodology and its appropriateness for Panamanian conditions are discussed; its potential for replicability is analyzed, a comparison is made with the more traditional experiment station research/extension service approach, requirements for credit and other commercial inputs are assessed, and engineering judgments about project costs are reported.

1. Rationale for the Use of the Area Focused Production Systems Research Strategy

IDIAP's strategy for the generation and dissemination of appropriate technology for the small and medium-sized farmer encompasses an area (or site) specific, or work zone campaign approach in which the following guiding principles are followed to ensure successful implementation of the project:

a. In order to assist the farmer to solve his production constraints, the research and technology transfer staff must first establish communications with him, become thoroughly acquainted with his production systems, how and why they evolved and learn about his desires and aspirations.

b. Generally speaking small farmers are efficient in the utilization and allocation of available resources among known technologies if they have been farming under stable conditions for some time. This implies that small farmers will, and do, accept change when the available resource base changes or new and appropriate technology becomes known. Otherwise they could not be efficiently adjusted to alternatives they now have.

c. There is a rather high degree of site or location specificity of the small farmers' agro-socioeconomic conditions. This is an important characteristic that must be considered explicitly if the technology generating and dissemination system is to produce technology modifications which small farmers will be motivated to accept and adopt. This also implies that any technology dissemination programs require full-scale collaboration with the technology generators, in-depth training to adequate numbers of "change" technicians, through area and regional diagnostic surveys, and expanded-area on-farm evaluation and validation trials.

d. Because farmers, are generally efficient in the allocation of their available resources to known appropriate traditional technologies, it means that the problem is not one of motivation per se, rather it is one of presenting technological modifications which are appropriate, i.e. which can be introduced within existing production systems and which are profitable.

e. In order to be able to understand and interpret the small farmers' agro-socioeconomic conditions, all factors affecting what systems they do use, must be considered. Hence it is indispensable for a well-trained multi-disciplinary team, each contributing his own specialty, but all subordinating to the common objective to make the area studies and establish the priorities.

The production systems research methodology is based on the premises stated above. The advantages of establishing this type of system within the Panamanian context are that:

a. It will permit IDIAP officials, administrators, and research workers to develop a more complete understanding of the target groups their motivations, their resources, their life-styles, and their problems.

b. It will allow technology generators to experiment with and validate technological modifications under actual field conditions which vary significantly in different regions of Panama.

c. It will permit GOP and private agencies to work out policies and input strategies that are feasible and practical.

d. It will minimize the impact of errors and reduces the time and investment in non-acceptable experimental results.

e. It will facilitate the integration of the research and dissemination processes, which are currently carried out by several different institutions including the Ministry of Agricultural Development, the Agricultural Development Bank, and the National Bank of Panama.

f. It will provide an ideal training laboratory for "change agents" from MIDA and the banks.

g. Above all, the Panamanian small farmer, as the primary potential adopter of improved technology, will become the primary concern or focal point of research efforts.

2. Summary of the Cost-Effectiveness of the Area Focused Production Systems Approach vis a vis traditional Research and Extension Activities

IDIAP's area-focused production systems approach to agricultural research requires a substantial investment in a large number of broadly-trained technicians who are capable of communicating with small farmers and of performing on-farm as well as experiment station research. Staff members must be provided with a high degree of mobility in order to effectively implement on-farm research and validation activities.

Also the expenditure of both time and money is required to carry out area diagnostic studies.

These factors mean that IDIAP will have to incur a substantially higher expenditure burden, especially for personnel, vehicles and farm equipment than if it were conducting traditional experiment station research.

On the other hand, the area focused research minimizes the need for investment in sophisticated research stations designed to provide optimal conditions for controlled experiments. Despite the apparently high cost of research using the area approach, the system is cost-effective primarily because: (1) it yields results more appropriate for small farmer conditions, minimizes the impact of erroneous research results and reduces total time and investment in non-acceptable experimental results and; (2) it facilitates the dissemination of the research results by incorporating the research scientists into the dissemination process and by serving as a training laboratory for "change agents" (extension personnel).

The area focused production systems methodology which stresses on-farm research and validation is oriented toward the dissemination of technologies which are likely to increase profitability under prevailing small farm conditions in the different project areas. It will minimize the likelihood of a repetition of a recent IDIAP experience in which a rice variety was developed which produced excellent results under controlled experimental conditions and optional production conditions with sufficient fertilizers and water but which gave very poor yields when lower than recommended levels of fertilizer were applied (as most small farmers tended to do) or when drought conditions occurred.

Rather than focusing strictly on varietal research, the production systems approach will focus on overall farm

planning. For example, it will consider how much fertilizer, if any, the farmer currently applies as well as a number of other technological, economic, social and physical factors which constitute a production system. The area-focused approach will result in recommended changes which fall within the known parameters of the system, i.e., they will consider factors such as farmers aversion to risk and the (limited) availability of credit or other production inputs. Hence the probability of being able to test and validate a large number of technological , modifications which will be appropriate to small farm conditions is significantly enhanced.

The participation of technology transfer ("change") agents in the research and, in particular, the validation process through their incorporation into the research teams is expected not only to directly link the development of agricultural technologies to their dissemination, a linkage often neglected in research activities but also it will provide excellent on the job-training for the change agents. At least two MIDA agents will be assigned permanently to each area. The function of these agents will be to carry out the major part of the small farmer technology dissemination in the geographic area to which they are assigned.

At the same time a larger number of MIDA, BDA and other agricultural sector personnel are scheduled to participate in field oriented short courses in the project areas. These personnel will actively participate in research/validation/ dissemination activities during the short courses. Approximately 88 agricultural technicians, are expected to participate in this activity. The majority of these are expected to come from MIDA and BDA regional offices as well as a number of MIDA personnel who work primarily with organized groups within the project areas.

The commitment of MIDA personnel to work with small farmers in the project areas means that a substantial cadre of extension personnel will have been trained in the cropping and/ or animal production systems approach. This will permit the more effective utilization of existing human resources in the technology transfer process and will facilitate broad dissemination of technology within each of the eight project areas at little additional cost.

When feasible, group activities will serve as a method of disseminating information about new technologies. Approximately one-tenth of the target population in the eight areas belong to organized groups (asentamientos, juntas comunales and cooperatives). See Annex III, Exhibit C.

MIDA's technology transfer activities are currently focused on such groups. An IDIAP/MIDA team has worked for more than two years with members of a potato cooperative in the Cerro Punta region of the Bugaba District. The ability of such a team to work directly with the target beneficiaries utilizing group organizations serves to reduce the costs of the technology transfer significantly.

In summary, while the area-focused production systems approach appears to be more costly than the more traditional because it requires additional field personnel and area infrastructure costs as well as some funding for additional on-farm experimentation, it reduces the number of extension personnel required in an area and encourages more effective utilization of these personnel who have a better knowledge of appropriate technological modifications to disseminate. Also, area focused research has a much greater probability of producing useful results which will be accepted by target group farmers than does the more traditional experiment station research.

3. Replicability

Diagnostic surveys will be carried out in two additional areas within the major agriculture regions during the project. These surveys will serve as the basis for an expansion of IDIAP's area - specific research activities over the longer-term, once IDIAP's staff program development is completed. In this context the issue of replicability is important. The area-specific production systems methodology does not develop technological packages that will be totally appropriate for or recommended in other regions of Panama. Widely varying ecological conditions within the country preclude this possibility. Nevertheless, there are some other areas with characteristics similar to the selected areas. Also, the number of factors within cropping and animal production systems which constitute variables most amenable to change are not extremely great in number. Furthermore basic types of technological modifications which are likely to increase on-farm income are known. Utilizing modern data collection and processing techniques the variables not likely to affect productivity in a given ecological contest may be readily identified and recommended technologies can be tested at the farm level in a relatively short period of time. That is, although the technological modifications developed in the eight project areas are not considered to be replicable without further field testing, the methodology itself minimizes the time required for additional field testing.

Although the expansion into other geographic areas of Panama will require the expansion or relocation of field staff, as well as additional investments in buildings, vehicles, and field equipment in the new areas, the additional cost per area, including MIDA support costs, is calculated to be $450,000 in current terms for a five year program, assuming that of the cost of support services, including multi-disciplinary teams and other support personnel, are relatively small for marginal changes in the number of areas serviced. Most support costs will not change significantly since much of the infrastructure (e.g. laboratories, the information center, and seed facilities) developed under the project can be used more intensively with the addition of a minimal number of personnel. Also, the multi-disciplinary teams will need to devote less time to areas where field research teams have worked for several years and are capable of carrying out research activities with only limited guidance from the high level research scientists.

A major issue of replicability concerns the availability of personnel to carry out the dissemination of the technology in additional areas. This has been a concern of the Mission for some time and is now receiving increasing attention within the Ministry of Agricultural Development. While it is beyond the scope of this project to deal with the national issue of the nature and administrative form of the public sector's Technology transfer/extension service, it is important to note that the circulation of IDIAP's long-range plan for review among agricultural sector personnel and the process of developing this project have required that MIDA focus on this issue at the highest (Ministerial) level.

4. Availability of Credit and Production Inputs

The introduction of new or modified agricultural technologies implies an increased need for credit and modern production inputs. The area-focused production systems approach considers both the availability of credit and inputs and the prevailing small farm cultural practices in the choice of technologies to be developed and introduced into an area. In those areas where small farm credit is limited, "credit-using" technologies which requires use of modern inputs will be de-emphasized to the extent possible.

Generally, credit is available to farmers in the priority areas through the BDA and, in some cases, through private banks. Annex III, Exhibit C, shows the loan amounts to individuals and groups by the BDA in the eight areas in 1978.

These amounts $6,483,000 and $3,848,000 represent 42% and 51% of all BDA loans to individuals and organized groups during that year. Although the areas served by the BDA offices are in some instances greater than the project areas, over-all credit availability is not a problem in most project areas.

Past experience, however, has shown that the BDA lent primarily to organized farming groups and to small and medium commercial farmers with an average net worth of $5,753 in 1977. Therefore, the diagnostic surveys must ascertain not only aggregate credit availability but also credit distribution within each area. Active involvement of BDA and BNP personnel in the area field research teams should facilitate expansion of credit to farmers who desire but currently do not obtain credit. In addition, projects, tentatively planned with the IDB and IBRD oriented toward small and medium farmers/ranchers as well as existing loans from these institutions to the BDA and BNP should provide a substantial amount of additional credit to at least some members of the target group. Nevertheless, credit availability to individual small farmers remains a concern and a constraint to the ultimate longer term and large scale success of the agricultural research program.

Production inputs are widely available compared to most other developing countries. Although most current utilization of these production inputs is by large and medium farmers, they are sufficiently widely available to meet increased demands by small farmers.

Most fertilizer is supplied from a Costa Rican plant which has a marketing outlet in Panama. Pesticides, imported from the U.S. and Europe, are available through a number of commercial dealers. Improved seed, whether developed by IDIAP or imported under IDIAP's supervision is available through the National Seed Enterprise (Empresa Nacional de Semillas).

A major constraint does exist with regard to available machinery services in some areas of Panama. A National Machinery Enterprise (ENDEMA) does exist. However, it primarily caters to organized farming groups, particularly asentamientos, and is not readily available to small and medium individual producers. Many of the latter who utilize machinery, rent it from other farmers who do own machinery. Nevertheless, the major part of Panamanian small farmers do not practice mechanized agriculture. This fact will be a determining factor in the types of technological modifications which are tested in the research program.

5. Project Cost Estimates

IDIAP's estimated costs for construction of the national headquarters and other facilities to be built under the project have been reviewed by the Mission's Office of Engineering Services. Estimates of current construction costs are reasonable. Relatively high rates of increase in construction costs, have occurred in Panama during recent years and there is uncertainty about future cost increases, therefore, a 10% inflation rate is assumed.

Equipment lists supplied by IDIAP have also been carefully reviewed and equipment costs are reasonable.

Except for the difficulty in estimating the future effects of inflation, especially on construction costs, project cost estimates are considered to be realistic, in line with functional needs, and consistent with costs incurred in other recent AID projects.

D. Administrative Analysis

1. Identification of Major Administrative Feasibility Issues.

The Project will be implemented by Panama's Applied Agricultural Research Institute (IDIAP), a semi-autonomous Institute. Although not part of the Ministry of Agricultural Development, (MIDA), it is directly responsible to the Minister of Agricultural Development who by law serves as the chairman of IDIAP's Board of Directors. IDIAP, formed from an agricultural research division of MIDA is by law responsible for applied agricultural research activities in Panama. Its charter also delineates the potential role for IDIAP in the dissemination of agricultural technology. From the perspective of its legal mandate, IDIAP is clearly the most appropriate institution to administer the project.

During various stages of project design, AID (both Mission and AID/W) personnel identified a number of issues related to the administrative feasibility of project implementation by IDIAP. Major issues were: (a) whether IDIAP has sufficient institutional capacity, especially adequate managerial and technical personnel, to implement the proposed research program; (b) whether the level of GOP commitment, particularly in terms of provision of an adequate budget was sufficient to allow successful achievement of project purposes; (c) whether the inter-institutional linkages, especially with MIDA and with the BDA, would be sufficiently strong to permit successful development of the dissemination technology transfer activity, (d) the role that the University of Panama's Facultad de Agronomía would play in applied research in Panama, and (e) the possible role for title XII universities in the project.

Mission personnel believe that these issues have been adequately resolved during the course of project design. The specific issues are addressed below:

2. IDIAP's Institutional Capacity

a. Administrative Capability: IDIAP's plan for strengthening its capability to carry out and disseminate agricultural research by increasing its technical staff, and providing training and practical experience for its technicians has been discussed in the project description. This section focusses on improvements in management and administrative capability that will be needed to enable IDIAP to support the

greatly increased level of operations called for under the project.

During the five year life of the project, IDIAP will, inter alia, more than double the size of its technical staff; construct and equip a new headquarters and other physical facilities; move the Chiriqui regional office from Gualaca to David; build, equip and maintain eight field offices; contract six long term and numerous short term advisers; arrange for training of 37 long term participants and many short courses; obtain more than forty new vehicles, and purchase significant quantities of equipment and agricultural inputs for field experiments. Its normal administrative tasks will increase along with its increased level of operations. IDIAP's budget, reflecting these increased operational responsibilities will increase from approximately $1 million in 1978 to approximately $3 million per year in the early 1980's.

At present, IDIAP's administrative and service staff consists of 157 employees who are stationed in the central headquarters in Santiago and in three regional offices which are located at the Santiago headquarters, Gualaca and Panama City. These regional offices are in charge of field operations in, respectively, the Veraguas, Los Santos and Herrera Provinces; Chiriqui province; and Panama province. The headquarters staff includes general management, planning and budget, and administrative service and finance functions. The regional offices contain decentralized purchasing and accounting functions and minimal service personnel.

As a result of a thorough analysis of IDIAP's administrative system, several areas where improvement is needed in management and operations have been identified:

(1) Procurement. Under the project, regional offices will purchase small quantities of supplies and equipment locally through off the shelf procedures. The existing capability of these offices, if it proves insufficient during implementation, can be easily augmented by hiring additional purchasing agents. Should similar capability be needed by the field offices, this too can be easily solved. However, the capability of the central administrative office, which currently has a total of 2 purchasing agents and will be responsible for the major procurement actions under the project, will need both significant reinforcing as well as short term technical assistance to avoid major delays in project implementation. A procurement specialist, familiar with both AID and GOP procurement regulations, will be contracted shortly after signature of the Loan Agreement, to train existing and new

administrative personnel in procurement practices (except for training services). The adviser will be responsible for training IDIAP personnel in procurement procedures and will assist them in the preparation of IFB's and RFTP's. IDIAP will assign two contract officers to receive training from the adviser and will initiate major procurement actions under his guidance. These officers will receive additional advice from AID officers after departure of the adviser. Training arrangements will be handled differently. IDIAP will assign responsibility for training programs to an employee who can spend full time on this activity. The Ministry of Planning and AID's Training Office, both of which have extensive experience in arranging training programs, will both provide technical advice to IDIAP in training programs procedures and administration.

(2) Program Management. At present, IDIAP's field teams function largely under the direct supervision of the Regional Directors and also receive guidance of advisers from international organizations (e.g. CATIE, CIMMYT, etc.) who are providing advisory services through technical cooperation agreements between IDIAP and their sponsoring institutions. As field operations increase, IDIAP will need to develop a more formal management structure to ensure adequate field performance from the more than two hundred technicians, advisers, agronomists and cooperating agency personnel (e.g. MIDA technicians) who will eventually be involved in field research and dissemination. To assist in developing its middle management, IDIAP will contract a research management adviser during the first year of implementation, to review its present operations and expansion plans and recommend an appropriate program management structure. The adviser will also recommend the kind of management training that will be needed to assist mid-level managers in developing their leadership and administrative skills. Finally, the adviser will also recommend improvements in administrative operations needed to ensure timely arrival of inputs to field sites and ensure thorough review and evaluation of field work by top management. In addition both long and short term training will be provided research center administration.

(3) Maintenance of vehicles and buildings.

IDIAP presently has three mechanics and two assistants on its headquarters staff. These personnel are responsible for the maintenance of IDIAP's present central fleet of 35 vehicles. Because of this there are very few vehicles assigned to field stations, as they can be rarely brought in for normal servicing or inspection, and are usually driven until they

break down. When breakdowns occur, either the field personnel make emergency repairs as best they can, find a local mechanic to make the repairs, or call Santiago to have one of the mechanics come out and fix the vehicle. With the acquisition of many more vehicles plus farm equipment to be procured under the Project, upgrading of IDIAP's vehicle maintenance capability will be needed. This capability will be improved in two ways. First, the project budget includes funds for shop equipment and a workshop which will permit the mechanics to adequately service the vehicles. Second, IDIAP has agreed to employ a competent shop foreman to administer shop activities and establish a program of regular maintenance for all IDIAP's vehicles and equipment. Additional mechanics will be hired as needed. Depending on the qualifications and experience of the shop foreman, technical assistance may be required to assist in establishing the maintenance program. If needed, a short term adviser will be contracted using loan funds.

Building maintenance is provided at present by two carpenters. Tasks which are beyond their capacity are contracted to local "building masters" (maestros de obra). This system is simple and functional and no additional upgrading appears necessary at this time.

b. Maintenance of technical capability while key personnel are receiving training.

In addition to improving its administrative capacity, IDIAP is also concerned about how best to utilize the currently limited amount of administrative and technical personnel in the implementation of an area-focused research program while, at the same time, the institutional development activity is underway and, moreover, a significant portion of its personnel are in training. This concern has been addressed through a number of different but related mechanisms. The use of multi-disciplinary teams requires that many of the more highly specialized research personnel participate only part time in each area. Because Panama is a very small country geographically, a high degree of staff mobility is feasible. (In fact it is possible to visit all eight project areas within a two-day period). Hence, these research scientists will be able to participate actively in a number of the area teams. In addition, the research activities will be time-phased. Technology adaptation efforts will begin in four of the areas (Renacimiento, Gualaca, Los Santos and Santiago) in year one. However, approximately one to two years will elapse before they are begun in the other four areas. This time-phasing will permit the required build-up of IDIAP's staff to be well under way before

full staffing of all project areas is required. Finally, experienced and highly qualified experts contracted to IDIAP in a long term basis will be an integral part of the research teams. They will not be "advisors", rather, they will actually engage in the research/dissemination process thereby filling critical gaps in technical expertise on the teams as well as providing an opportunity for inexperienced junior counterparts in their fields to learn by working directly with the technical experts. The experts will in effect replace more senior Panamanian staff members who will be studying for advanced degrees. These measures should alleviate major staffing constraints on the effective implementation of the area-focused program.

3. Level of GOP Commitment

During IDIAP's first two years of operation, the level of budgetary support was limited and did not increase significantly in real terms. (NOTE: Because of Panama's economic difficulties which affected the government's capability to generate revenues through taxes during the 1976 - 1978 period, most GOP centrally-financed agencies and ministries budgets declined in real terms while IDIAP's budget was increased somewhat). USAID/PANAMA manifested concern about the level of the GOP's financial commitment to IDIAP in 1976. Despite the strong support of the Minister of Agricultural Development for a substantial increase both in IDIAP's operating and investment budget, significant support was not forthcoming until this year.

In the 1979 budget law, IDIAP's budget was increased substantially. The operating budget was increased by 70% from $880,000 to $1,433,000 while the investment budget was increased by 300% from $150,000 to $595,000 (not including loan funds). These increases plus other income totalling approximately $60,000 meant that the total amount of resources available to IDIAP increased by 82% between 1978 and 1979. The increase in IDIAP's operating budget assures that a substantial expansion of IDIAP's permanent staff will take place. In addition, the renewed GOP commitment, evidenced in this year's budget law, to assure that international loans are fully matched with local counterpart funds implies a strong measure of support for the institution in the coming years.

4. Inter-institutional linkages with MIDA and the BDA

Two concerns that arose during project development were how the research activity should be linked with the dissemination of the new or modified technologies and, more

specifically, how IDIAP's activities would relate to the extension activities carried out by MIDA and BDA personnel. Questions were raised about the possible need for a separate extension service within the Ministry of Agricultural Development. Currently, extension/promotion responsibilities are divided among a number of MIDA divisions including Crop Production, Animal Production and Social Development, and for several years have been limited primarily to servicing organized peasant group farms (asentamientos). This situation has complicated attempts to expand dissemination of appropriate agricultural technologies on a comprehensive basis.

The development of a research methodology in which dissemination activities flow logically from the research/validation effort and are carried out by the same area field research teams resolves the issue of inter-institutional collaboration. At the same time, it obviates the need to address the question of establishment of a separate bureaucracy for extension-type activities. The project description mentions that the Ministry of Agricultural Development has agreed to provide to production agents in each priority area and that MIDA and the BDA have agreed to provide a number of personnel for short training courses in each project area. The commitment made by the Minister of Agricultural Development on this matter will operationalize intensive expansion efforts in the project areas and will provide effective "on-the-job" training for agricultural sector personnel who carry out extension functions. Without doubt, personnel from the other agricultural sector institutions who participate in this program will have a much better knowledge of the new production technologies than if they were only exposed to them through short courses and field days. It will also assist MIDA and the BDA in their efforts to expand their extension and credit efforts from a concentration on asentamientos toward an area focused approach in which individual small and medium farmers are provided extension services. The Mission perceives this form of extension as a natural and related part of the research activity.

The coordination between IDIAP researchers and personnel from other agricultural sector agencies may be difficult to coordinate effectively at the outset, especially to assure that personnel from other agencies are on-site and incorporated effectively and in a timely manner. In order to assure that effective coordination will in fact be achieved, MIDA will prepare a detailed plan in which its precise role is clearly and precisely identified for each area and where the MIDA personnel who will initially participate in the project have been identified.

5. The Role of the Facultad de Agronomía (FA) in Agricultural Research.

The University of Panama's Agronomy Faculty has been engaged in agricultural research activities for several years. In the recent past the FA has had a number of PhD's on its staff and AID has supported FA research programs in soybeans and sorghum. These research activities have been primarily centered at the FA's experiment station at Tocumen, focusing primarily on varietal research. Despite the fact that the FA's research has been an adjunct to its teaching program, it has had the majority of Panama's well trained agricultural scientists. Given this fact the Mission Director wrote to the Minister of Agricultural Development in 1976 to request a clarification of the role that the FA might play in agricultural research in Panama. However, since that date, a number of professors have resigned from the FA, because a decision has been made to transfer the Agronomy Faculty to David, Chiriqui Province and because staff salaries have not been maintained at competitive levels. Consequently, the FA's present ability to undertake an extensive research program is limited.

This situation does not mean that the Faculty's role in the project should be ignored. In fact, the Faculty has expertise which must be brought to bear on difficult technical problems. However, given the faculty's present situation, it is difficult to establish a formal, on-going role for the FA in agricultural research. Therefore, in order to assist the FA during its transition, funds will be available in the form of research contracts for projects which are needed by IDIAP but are in areas in which its capability is limited. This mechanism will be advantageous for both the Facultad and IDIAP. It will facilitate maximum use of available in-country research expertise and will help to avoid duplication of research activities. In addition, USAID is exploring the possibility of funding a small project which would allow FA staff and students to obtain valuable field research experience.

6. Possible Role for Title XII Universities

As a result of the visit of a title XII team to Panama on May 18-23, 1979, both IDIAP and mission personnel are throughly familiar with the Title XII program. While IDIAP has yet made no commitment to the Title XII program a number of their staff members are graduates of Title XII universities (e.g. University of Florida, Michigan State) and are aware of U.S. university capabilities. A major concern manifested by the director of IDIAP pertained to whether IDIAP would have the right to

reject technical experts proposed under a Title XII activity who in its judgement were not fully qualified.

IDIAP and Mission personnel have agreed that much technical assistance, especially that related to the dissemination/extension aspects of the project, and potentially all of the technical assistance, might be appropriate for Title XII universities. Alternatively, IDIAP may decide to submit all technical services requirements to formal competition with the full expectation that a number of Title XII universities/consortiums would submit proposals.

E. Environmental Concerns

This project seeks to develop the institutional capability of IDIAP to investigate the characteristics of existing small farmer crops and farming systems and to adapt known technologies to improve them. A major part of this research will be carried out on volunteer smallholder farms in conjunction with the farmers. The resulting economic practices and technology will be disseminated by change agents who work closely with the researchers and the farmers. In some instances on-farm research trials and the technology adaptations recommended to small farmers may include the use of pesticides.

The project's institution building activities will produce little or no environmental impacts. Most of the project's research/technology dissemination activities should produce highly positive impacts on Panama's natural and human environment since they will reduce deforestation, erosion and sedimentation of water resources and improve socio-economic conditions for the rural farmer. A potentially adverse effect, the increased use of pesticides, was carefully evaluated by a pesticides expert and it was determined that such pesticide use would not present any significant environmental hazard because of the small amounts of pesticides utilized in research and validation trials and the close supervision which trained IDIAP personnel give to pesticide use by participating farmers. In addition, IDIAP and MIDA personnel will be trained in and will become advocates for integrated pest management within the eight geographic areas.

The pesticides proposed for use in the project have been reviewed by a qualified plant protection specialist. Since some of the pesticides are under rebuttable presumption against reregistration (i.e. acceptance) by EPA, an Environmental Assessment of the proposed pesticides was prepared by the specialist. Certain other pesticides whose registrations are likely to be cancelled by EPA in the immediate future have been included for comparative purposes in limited field trials. It was found that adequate safeguards have been included in the proposed trials including, in some instances, destruction of crop residues which may contain perticides. Hence, the Environmental Assessment concludes that the benefits of the proposed uses significantly outweigh the risks and that the project has been designed in such a way that there are no reasonably foreseeable significant adverse environmental impacts.

The Mission, therefore, recommends that the project be given a Negative Determination. AID personnel will carefully monitor pesticide usage to assure that IDIAP follows established EPA guidelines. When specific pesticides to be used for "on-farm" research are identified, IDIAP will inform AID in writing of the proposed use of the pesticide, including how it is to be used (i.e. for what crops, possible application rates), and safeguards to be followed in the application of the pesticide.

V. FINANCIAL PLAN

A. Introduction

The overall benefit cost analysis presented in Section IV.A provides the principle justification for the Project's financial soundness. This section covers the basis for the development of the Project budget, the allocation of costs between AID and the GOP, the recurring costs to the GOP, and an analysis of IDIAP's operating and capital investment budget. The Overall Financial Plan and the projected disbursement schedule for the Project during its five year life is shown in Annex VII, Exhibit F. The various subactivities are not justified financially in and of themselves, since, as integral parts of the Project, their justification is based on their essential contribution toward the achievement of the Project goals. The purpose of this analysis is to determine that the Project budget is adequate to carry out project goals. Some subactivities terminate during the life of the Project; for others that continue beyond, the capability to cover recurring costs is discussed in Section C of this analysis.

The total cost of this Project is $14,000,000 with loan and grant funds providing $6,000,000 and $1,000,000 respectively and the GOP providing $7,000,000.

B. Budget and Cost Analysis

There are two major components of this Project, Area Focused Research Activities and the Institutional Development of IDIAP.

1. Area Focused Research Activities

Research to be carried out in the eight priority areas accounts for $9,609,000 of the Project costs. While these costs are directly related to the area research, there are costs identified under the institutional development component that also will benefit the area research activities such as training and laboratory equipment costs. No attempt has been made to pro rate these types of institutional costs to project areas.

Construction of subcenters, expansion of regional research centers and seed processing and storage facilities are costed at $811,000. The AID loan will finance construction costs in the eight priority areas estimated at $451,000 and the GOP will provide $360,000. Costs of construction at current prices have been inflated by 10% per year. It is contemplated that the construction

will be done by contract administered by IDIAP.

To support the area research activities, equipment and materials will be provided in the amount of $1,777,000 of which $1,411,000 will be loan funded and $366,000 will be GOP funded. The detailed equipment and material list is shown in Annex VIII and consists of tractors, field implements and tools, research and demonstration equipment, materials for research experiments, seed processors and driers, equipment for laboratories, information, education and communications (I,E and C) equipment and materials, office furniture, typewriters and workshop tools. Current price estimates plus a factor for inflation have been used to cost this component.

Vehicle purchases, to support transportation requirements of personnel and delivery of supplies, are estimated at $635,000. The loan will provide $422,000 and the GOP will provide $213,000.

Technical Assistance requirements ($1,210,000) are detailed in Section III, C.3.c. and Annex VII, Exhibits D and E. They are based on IDIAP's needs as established in the five year plan and have been adjusted to fulfill specific project requirements. Loan funds will provide $210,000 and grant funds will provide $1,000,000 (used entirely to fund Geographic Code 000, U.S. source technical assistance). It is estimated that 149 person-months of long term technical assistance costed at $6,800 per person month and 27 person-months of short term technical assistance costed at $7,200 per person-month will be required. These rates are considered reasonable in view of current Mission experience and allowing for probable cost inflation during the life of the Project. It is contemplated that AID will contract for the Technical Assistance required under the Project since it is important that the technical assistance be in place early in the Project and, at the present time, IDIAP does not have the expertise to do the contracting in an expeditious manner.

Operational costs of IDIAP personnel staff time over the five year Project are estimated at $3,584,000. Fuel and maintenance costs are estimated at $500,000 for the vehicles and field equipment to be provided. Costs for other Agriculture Sector MIDA personnel are calculated at $592,000.

Complementary research activities consisting of an Integrated Pest Management Program (IPM) and research grants are estimated at $500,000. The IPM program will

require training courses, translation of existing documents to Spanish, testing and materials dissemination.

In summary, the total direct costs associated with Area Focused Research Activities total $9,609,000. The direct beneficiaries as described in the Project Description total some 9,000 farm families. This results in an average cost per farm family of $1,067.

2. Institutional Development

Construction at IDIAP's National Headquarters in Santiago are estimated at $1,773,000. Loan funds will provide $883,000 for construction of offices, labs, workshops and vehicle sheds, and greenhouses. GOP counterpart funds will provide $890,000 for construction costs as well as for A & E costs site preparation and interior finishing. Current cost estimates plus a 10% inflation factor per year were used to cost this component. Construction will be by contract administered by IDIAP.

To support the headquarters operations, equipment and material to be provided are costed at $591,000 of which $473,000 are from loan funds and $118,000 are GOP counterpart. A detailed equipment list is provided in Annex VIII and consists of laboratory equipment, I, E and C equipment and materials and office equipment and furniture. Every effort will be made to provide office furniture through the situs Excess Property Program.

Vehicles assigned to headquarters will be provided by GOP counterpart funds ($47,000).

Technical assistance will be required in the area of institutional strengthening. The loan will provide approximately 37 person-months of long term technical assistance costed at $6,800, and 7 person-months of short term technical assistance costed at $7,200 per person-month.

The most important component of the institutional development process is in training. The estimated five year requirement for training involves 1,450 person-months costed at $1,000 per person-month. The loan will provide $1,350,000 in training costs and the GOP will provide $100,000 in travel costs and incidental expenses. The $1,000 per month cost is reasonable based on current experience in which average costs of current training in the U.S., Central America and South America were inflated to cover rising costs throughout the life of the

Project.

Operational costs for the headquarters office administration are estimated at $160,000 in salaries for the five years of the Project. Fuel and maintenance costs for vehicles are estimated at $70,000.

In summary the $7,000,000 in AID Project funds provide construction, 19%; Equipment, Materials and Vehicles, 33%; Technical Assistance, 22%; Training, 19%; and Complementary Research Activities, 7%.

C. Recurring Costs

Recurring costs, especially personnel costs are a very significant element of this Project. This fact has been discussed with IDIAP and the Ministry of Planning and Economic Policy (MPPE). The fact that in anticipation of this project, the Central Government provided a 97% increase in IDIAP's CY 1978 budget demonstrates GOP interest in this Project and in providing the human resources needed to carry it out.

It is estimated that during the life of the project personnel costs for area research activities will start out at $449,000 for FY 1980 and increase to $566,000, $745,000, $870,000 and $954,000 in FY 1981 through FY 1984 respectively. Further, it is expected that personnel costs in the five years after the AID commitment ends will amount to an additional $5,000,000 as a result of continued but less costly efforts in current priority research areas, where greater efficiency will be achieved as a result of training and experience in the area, as well as some personnel costs incurred as a result of moving into two new priority areas.

Other recurring costs are fuel and maintenance expenses for the vehicles to be provided under the Project. Replacement of vehicles will probably occur after the AID commitment ends, assuming a five year life for a vehicle.

Based on the GOP's allocation of additional budgetary resources to IDIAP in CY1979 and other factors which indicate its strong commitment to agricultural research, it is anticipated that IDIAP will have sufficient resources to meet recurring costs.

D. IDIAP Budget Analysis

This section provides an analysis of IDIAP's budgets from its inception in 1976 to the present budget for 1979.

The following table presents in summary form operating and capital investment budgets, represented by transfers to IDIAP by the Central Government:

BUDGET ($000)	1976	1977	1978	1979
Operating	$650	$750	$ 880	$1,433
Capital Improvement	120	150	150	595
Total	$770	$900	$1,030	$2,028
Increase		17%	14%	97%

Additionally, IDIAP has miscellaneous income from production of grains, sales of seeds and a small amount of other income. The 1978 other capital and miscellaneous income accounted for $80,000 and $116,000 respectively, available for IDIAP's use. The 97% increase in the budget was a direct result of the GOP's awareness of the additional costs that it will incur under the Project.

The following table presents a comparison of 1978 and 1979 budget by source of funds and the application of these funds:

Source	1978 ($000)	1979 ($000)	Percent Increase
Operations: Central Government Transfers	$ 880.0	$1,432.6	63%
Miscellaneous Income	116.0	59.0	(97%)
Capital Investment/ Central Government Transfers	150.0	594.9	297%
Total	$1,146.0	$2,086.5	82%
Application			
Salaries and Social Security	839.2	1,102.5	31%
Non-Personal Services	43.7	109.9	151%
General Expenses	47.2	158.0	235%
Investment	150.0	964.9	543%
Machinery & Equipment	65.9	121.2	84%
Total	$1,146.0	$2,456.5	114%

The $370,000 difference between the sources and the applications of funds is covered by a line item, External Credit (AID), in IDIAP's budget for CY 1979. The actual AID contribution through CY 79 will probably be less than $370,000.

VI. IMPLEMENTATION PLANNING

The area-focused applied agricultural research/dissemination process, as described in Section III.B. of the PP necessarily requires a period of several years before benefits can be expected. In order to maximize the positive benefits generated from the research activity IDIAP must ensure that several activities, especially procurement actions, are initiated in the first year of the project. A time-phased project implementation plan is contained in Annex VII, Exhibit A. This plan shows that IDIAP must undertake three distinct pre-implementation activities in the areas of long-term training, contracting of technical assistance and procurement of vehicles and key field equipment. First, training sites must be selected and application procedures initiated for 15 candidates for long-term training who should begin their studies in January 1980. Second, a request for Technical Proposals must be developed for the major part of the technical assistance required for the project. Third, specifications for an IFB must be prepared for the acquisition of field equipment and vehicles for the first four porject areas.

IDIAP will assume responsibility for procurement of most goods and services under the project; however, because of limited staff and lack of prior experience with AID funded project it is expected that they will require substantial assistance from USAID personnel during the pre-implementation phase and the first year of project implementation in order to execute these actions on a timely basis.

In addition a procurement specialist will be contracted with project funds so after signature of the loan agreement this specialist will work with and train IDIAP personnel in contracting procedures.

Technical assistance is a key element in this project. Because of its extreme importance for the successful implementation of the area-focused production-systems research activity, a substantial part of the T.A. funding will be in the form of a grant. Also, it may be directly contracted by AID if it is determined that host-country contracting would excessively delay the procurement of technical services. IDIAP would be responsible for logistic support of all technicians.

Grant-financed technical assistance will be restricted to AID Geographic Code 000 source firms. The major portions of the long term technical assistance, related to agricultural research activities, will be procured through formal competition, i.e. through the issuance of an RFTP.

Construction of the area sub-centers will be contracted individually to Panamanian firms only because of their widely dispersed locations and the very low value of these construction services. (Total cost including A & E and contingencies is approximately $800,000). The construction of the National Headquarters at Santiago will be bid internationally. All procurement will be done on a competitive basis.

VII. EVALUATION ARRANGEMENTS

Project evaluation will be carried out on two levels. Progress toward attainment of project outputs and utilization of inputs will be evaluated jointly by IDIAP and USAID/Panama on an annual basis. Although these evaluations will be done within a context which considers goals and purpose, they will focus primarily on the degree of efficiency in project implementation.

The annual evaluations will focus on overall project design and implementation. In particular they will evaluate progress in the following major areas:

1) The effectiveness of the area-focused production-systems research program in each geographic area;
2) Training and staff development;
3) Provision of facilities including development of the headquarters and area facilities;
4) Procurement of equipment and materials;
5) Performance of technical experts;
6) Inter-institutional collaboration and linkages with institutions carrying out farmer service programs;
7) The degree to which recommendations of earlier evaluations have been incorporated into the project implementation process.

The progress indicators established in the logical framework will serve as benchmarks in this evaluation.

The annual evaluation will in particular try to identify bottlenecks in the implementation process and propose remedial measures, including modifications in project design and more effective implementation procedures, if required, in order to improve project performance. Results of this annual evaluation will also be utilized in the development of IDIAP's annual operating plan and for its annual budget submission to the Ministry of Planning and Economic Policy. Data for this type of evaluation will consist primarily of project documentation as well as the results of the validation process which has been built in to the research/dissemination methodology. The evaluation will be undertaken each year between July 1 and September 30, beginning in 1980. It will culminate in an annual loan review to be scheduled during the fourth quarter of each calendar year.

A second type of evaluation will focus primarily on achievement of project goals and purposes. In particular it will focus on the results of the area-focused production systems research and

dissemination activity. This evaluation will be carried out in the fifth year of the project and will serve as the end of project evaluation. In order to help develop IDIAP's evaluation capability, it will be carried out primarily by IDIAP personnel with the help of CATIE and/or project funded evaluation experts. The evaluation, will consist primarily of the application of survey instruments similar to those which have been or will be used in carrying out the area diagnostic studies which constitute the first step in the area focused research process. The latter studies provide the baseline data required for the evaluation. Comparison of the two sets of studies will demonstrate the degree of technological change which has occurred on project area small farms and, concomitantly, the change in small farmer net incomes attributable to those technological changes. IDIAP is considering, as resources permit, the selection of 1 or 2 control areas in addition to the eight project areas where baseline data would be gathered during the first or second year of the project and where an area evaluation would be undertaken during the fifth year of the project. Use of these control areas would assist in the determination of those changes which are attributable to the research dissemination activity. In addition to evaluating attainment of goal and purpose, the final evaluation will attempt to correlate the degree to which research outputs are achieved with the level of goal and purpose attainment through appropriate inferential statistical techniques.

VIII. Other Donor and Related AID Activities

A. IDIAP's collaboration with International Research Institutions

IDIAP has established good working relationships and signed agreements with several international institutions. The policy of collaborating with such institutions results from the Institute's philosophy of utilizing all available technology that may be applicable or adaptable to Panamanian conditions. Also, IDIAP is interested in taking maximum advantage of staff training and development facilities available through the various international institutions. Finally, the exchange of literature plant genetic material, and research information and ideas through visits and meetings are important to the long term development of the Institute.

IDIAP's major linkages with international research institutions are summarized below:

1. The Centro Agronómico Tropical de Investigación y Enseñanza (CATIE)

IDIAP's working relationship with CATIE is well developed. CATIE represents a fundamental source of technical expertise and information to support IDIAP's research activities.

CATIE's collaboration with the Panamanian Government dates back to April 8, 1974, when a technical cooperation agreement between IICA and MIDA in support of a cattle research program was signed. The principal objective of that agreement was strengthened when the Government of Panama became a full partner of CATIE in 1975. With the creation of IDIAP, even closer collaboration developed between personnel of the Animal Production Programs of CATIE and those of the Animal Science Programs to IDIAP. The collaboration was reinforced in 1978 with a new IDIAP-CATIE-IICA agreement in which CATIE's collaboration was formalized through a new agreement to extend over a 4-year period. This agreement also includes research in agricultural production systems as well as animal production systems.

CATIE's collaboration has focused on planning, organization, programming, implementation, analysis and diffussion of agricultural research in Panama. This task is currently being carried out with the assignment of a full-time resident technician in Panama combined with short-term visits

by other CATIE and IICA technical personnel totalling an average of 150 man-days per year. The agreement includes the training of national technical personnel, both on-the-job and through the use of short courses, workshops, seminars, observation trips, diagnostic studies, postgraduate training at the MS level and others, and implemented both in Panama and at CATIE. Also, computer services and analyses have been provided by CATIE.

The collaboration between CATIE and IDIAP established in the new agreement will be implemented through three area research projects which will be jointly coordinated by CATIE and IDIAP but which constitute integral elements of IDIAP's area focused production systems research. Two financed by USAID-ROCAP, are for research in small farmer animal production and cropping systems; the other, financed by IDB is for research in milk production systems for small farmers with limited resources. All projects will follow CATIE's and IDIAP's research methodology whereby research at the small and medium farmer level is (1) carried out in an integrated and multi-disciplinary manner and where (2) the problems to be investigated are the results of an assessment of the farmers' activities and their productivity limitations. In the search for solutions an effort is made to utilize the resources that the farmer has on his farm, so that the investigation is not considered as crop or livestock oriented in separate forms, but must be integrated into the total farming system.

The new projects include the assignment of three resident technicians in Panama. Two specialists in Animal Production and one in Crops will be provided for 4 years. One of the animal production specialists will be on a half-time basis. These technicians will work within IDIAP's research programs and be integrated into multi-disciplinary teams in the priority areas previously established by IDIAP.

The new projects also provide the possibility of back-stopping by all of CATIE's technical personnel, as well as components for training, research in technology transfer and extrapolation of the research results. Training programmed within the projects will include training at CATIE, organization of short courses, seminars, workshops, etc., both in Panama and other countries, as well as in-service training.

2. The Instituto Inter-Americano de Ciencias Agrícolas (IICA)

IICA has operated a regional office in Panama for some years and has provided a small number of technical experts to work with Panamanian agricultural sector agencies. The primary contract between IDIAP and IICA has been through the ROCAP/IICA Central American Agricultural Research and Information Systems Project (PIADIC). The focus of the PIADIC project has been to assist in the development of a National Agricultural Information System. The PIADIC project is to provide the Panamanian agricultural sector including IDIAP with: (1) better agricultural production statistics through an improved area sample farms; (2) an improved marketing data base; and (3) the provision of appropriate technical information from non-Panamanian information services. The latter activity is being coordinated closely with IDIAP and will be particularly useful for IDIAP's medium-term research effort while the two former activities, which are being developed with the Statistics and Census Directorate and the Agricultural Marketing Institute, respectively, will require some time to develop and will be more useful over the longer term. Also, PIADIC personnel will examine IDIAP's data base and data processing requirements over the next several years and will make recommendations to IDIAP about which type of computer system would be best suited to IDIAP's requirements and budgetary resources.

3. The International Research for Development Center (IRDC)

The IRDC is providing assistance to IDIAP for a project involving the development and transfer of technology to help solve problems of small and medium ranchers involved in milk/beef production in Panama. Financial assistance for research and training are being provided. This project complements CATIE's activity and will also complement the AID financed project. The IRDC's three year grant totals $150,000. In addition, the IRDC is offering IDIAP scholarship support in the area of research center management.

4. CIAT, CIP and CIMMYT

IDIAP has working agreements with the Tropical Agriculture Research Center (CIAT), the International Potato Center (CIP) and the International Center for Corn and Wheat Improvement (CIMMYT). These centers provide technical collaboration and training in the priority commodities, CIAT's assistance focuses on pastures, yucca and beans as well as seed technology. CIP provides seeds and assistance for potato production. CIMMYT is cooperating in priority areas where corn and sorghum are being produced.

IDIAP is making maximum use of the opportunities provided by the aforementioned centers and programs to provide short and long-term training for its personnel, to obtain short and long-term technical assistance and to obtain needed technical information and research inputs (e.g. seeds). The AID financed activities will not replace or duplicate this assistance. Rather they will complement it. In the training and technical assistance plans the assistance to be provided by these institutions has been fully considered and AID financed training and technical assistance will be in areas not filled by programs with these institutions.

B. Inter-American Development Bank support of the Facultad de Agronomía

The IDB has recently approved a loan to the GOP for higher education. Under this loan $2,310,000 will be utilized to complete the transfer of the Facultad de Agronomía to David, Chiriquí. The major portion of these funds, $1.585 million, will finance the construction of a new facility in David. The remainder will be utilized to equip and furnish the facility ($525,000) and to provide technical assistance training for university professors ($200,000).

The transfer of the FA to David is designed to provide larger and better physical facilities (labs and experiment stations) which are programmed to be available by 1981. However, it may well exacerbate the FA's current difficulties in retaining staff.

C. Related AID Activities

A substantial percentage of AID's recent lending in Panama has focused on rural development activities designed to benefit small farmers. The majority of the projects currently being implemented are complementary to the Agricultural Technology Development Project.

The Rural Cooperative Development Loan has provided significant technical assistance and credit to the Federation of Agricultural Cooperatives, COAGRO and the member institutions. Credit amounting to $4,000,000 has been supplied in a revolving fund basis for infrastructure ($1,000,000), working capital ($1,450,000) and production needs ($1,450,000). The latter is relent to individual members. Although this project is nearing completion, credit reflows will continue to be available to cooperatives, including those in project areas, primarily to facilitate the procurement of needed production inputs.

The Grains and Perishables marketing loan is designated to increase the capacity of the agricultural marketing system though the construction of large grain storage facilities as well as a large number of small buying stations located throughout Panama.

The Rural Growth and Service Center Loan also focuses on activities which will strengthen linkages between the rural small farmer population and the small and medium cities which provide services to rural areas. This project will benefit the areas included in the Agricultural Technology Development Project by developing agro-industries and small businesses in the cities of David (Chiriqui), Chitre - Los Santos (Los Santos) and Santiago (Veraguas).

The Rural Access Roads Project provides $10.0 million loan funds to upgrade rural farm-to-market roads to all weather roads. During the 1979 dry season 111.5 kilometers of roads are being constructed in the Renacimiento district. Final selection of roads to be up-graded in future years has not been made, however, it is likely that roads in Soná and Montijo will be among those upgraded in this project.

The Watershed Management Project, which is being implemented by the Directorate of Renewable Natural Resources (RENARE) of the Ministry of Agricultural Development has a number of activities which will be closely coordinated with IDIAP. Although project areas do not overlap, except in the Los Santos District which contains part of the Rio La Villa Watershed, several activities in the two projects are complementary and will require coordinated actions between IDIAP and RENARE.

The specific areas are soil conservation and pasture improvement. IDIAP and RENARE personnel have been meeting on a periodic basis to determine how these activities may be coordinated.

Finally, the Tonosí Integrated Rural Development project was intended to have a research input from IDIAP. However, because of difficulties related to the land redistribution element of the Tonosí project, activities in that area, including plans for IDIAP's production systems research, have been suspended pending final resolution of these difficulties. If and when IRD activities are resumed IDIAP will initiate implementation of an area focused research effort in Tonosí.

IX. Negotiating Status, Conditions and Covenants

A. Negotiating Status

IDIAP has closely coordinated with Mission staff on project design which is based directly on IDIAP's long term planning document. Representatives of the Ministry of Agricultural Development and the Ministry of Planning and Economic Policy have reviewed project documents and concur with project design.

Counterpart funds for the project have been included in the GOP's FY 1979 budget. There are no major issues which require substantive negotiation. Upon authorization by AID/W, USAID and the GOP will negotiate the project loan agreement. The GOP will then submit the agreement to the National Financial Commission and the Cabinet Council for approval, after which the project loan agreement can be signed. GOP loan negotiations are familiar with and have previously accepted AID's standard loan agreement provision.

B. Conditions

In addition to the standard conditions incorporated into AID project agreements, the Mission proposes the following conditions precedents to disbursement.

1. Conditions Precedent to Disbursement of Field Activities in each Geographic Area.

"Prior to any disbursement, or to the issuance of any commitment documents under the Project Agreement for field research and validation trials in each geographic area, the Cooperating Country shall furnish in form and substance satisfactory to AID:

(a) Evidence that required diagnostic studies have been completed and analyzed and a research plan developed for that area which shall include an analysis of the need for complementary inputs and a description of the arrangements for obtaining them.

The purpose of this condition is to assure that project funds are efficiently directed toward appropriate research targets and that any increased demand for credit or production inputs which is generated as a result of a new or modified technologies can be met.

(b) "A plan from the Ministry of Agricultural Development which describes the role, personnel and other contributions of each institution that will be involved in the dissemination of the results of the research to Panamanian small farmers, including a specific plan for the participation and training of

Ministry of Agricultural Development Personnel in this activity."

The purpose of this condition is to assure that the results of the research are fully and effectively disseminated among target group farmers within the eight project areas and that the Ministry of Agricultural Development Personnel involved in the technology transfer activities are familiar with and know how to disseminate the agricultural technologies developed and tested by IDIAP.

(c) "A detailed plan for the use of long-term technical assistance in carrying out the research activities and evidence that arrangements have been made to obtain the technical services specified in the plan."

The purpose of this condition is to ensure that the technical assistance which is critical to project success, be made available on a timely basis. IDIAP is fully committed to the use of external technical assistance. However, GOP procedures to obtain technical assistance tend to be cumbersome and slow. Consequently IDIAP personnel must initially focus a major part of their attention on this aspect of the project.

2. Condition Precedent to Disbursements for Activities financed by IDIAP's Contract Research Fund.

"Prior to any disbursement or to issuance of any commitment documents under the Project Agreement for research contracts financed by the IDIAP research contracts fund, IDIAP shall furnish in form and substance satisfactory to A.I.D. a plan for the use of such funds."

The purpose of this condition precedent is to ensure that the research contract fund is utilized in an effective and rational manner for priority research which is necessary for successful implementation of the area focused production systems research activity.

C. Covenants

The following covenant is considered to be appropriate for inclusion in the project agreement:

"Prior to the procurement or use of any pesticide financed under this agreement, the GOP and AID/Panama will confer regarding the proposed procurement or use of the pesticide and will jointly prepare and describe in writing a plan as to how the pesticide will be used and the safeguards to be followed."

The purpose of this covenant is to assure formal compliance with AID regulations. IDIAP currently has sufficient staff expertise to ensure that pesticides are used judiciously and with the necessary safety precautions.

AID 1020-28 (7-71)
SUPPLEMENT I

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

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

Life of Project:
From FY 79 to FY 84
Total U. S. Funding $7,000,000
Date Prepared: July 17, 1979.

Project Title & Number: AGRICULTURAL TECHNOLOGY DEVELOPMENT

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Program or Sector Goal: The broader objective to which this project contributes:	Measures of Goal Achievement:		Assumptions for achieving goal targets:
Sector Goal To improve distribution of the benefits of the agricultural development process.	Small farmer incomes increase by 9% per year.	Final Project Evaluation (data from baseline and follow-up diagnostic studies) Other census and survey data.	Increased production is not offset by lower prices. Panama's small farmer adopt technologies.
Program Goal To develop agricultural technologies which are appropriate for Panama's small farmers.	Adoptation of new or modified technologies by 30% or more of Panama's small farmers who are exposed to them.	Final Project Evaluation (data from baseline and follow-up diagnostic studies	

AID 1020-2B (7-71)
SUPPLEMENT I

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Life of Project:
From FY 79 to FY 84
Total U.S. Funding $7,000,000
Date Prepared:

Project Title & Number:

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Project Purpose:	Conditions that will indicate purpose has been achieved: End of project status.		Assumptions for achieving purpose:
1. To initiate or expand production systems research activities in eight priority areas.	1. Production systems research being conducted in eight areas.	1. Project files	1. GOP continues to support agricultural research activities
2. To enhance IDIAP's capability to carry out agricultural research on a continuing basis.	2. IDIAP begins research in at least two additional areas.	IDIAP records	
	3. Trained personnel are producing production systems recommendations.	IDIAP records, publications	

AID 1020-28 (7-71)
SUPPLEMENT 1

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Life of Project:
From FY 79 to FY 84
Total U.S. Funding $7,000,000
Date Prepared:

Project Title & Number:

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Outputs:	Magnitude of Outputs:		Assumptions for achieving outputs:
I. Research Activities	Year 1 2 3 4 5 10		
A. Area Focused Research			
1. Area diagnostic studies completed.	8 10 10 10 10 10 studies	IDIAP records	1. Research process yield specific recommendations for improved technologies
2. Field experiments conducted	200 465 730 995 1250 2520 field experiment	IDIAP records	2. Small farmers are willing to collaborate in on-farm experiments.
3. Recommendations for specific technological modifications.	0 0 10 20 30 60 recommendations	IDIAP records project files	
B. Complementary Research Activities			
1. IPM Program			
a. Data on pesticide usage compiled and analyzed	Report containing data and analysis for 8 project areas	Project files	
b. IPM materials adapted	1 package IPM materials in Spanish	Project files	
c. IPM plan			
d. Establishment of IPM laboratory	Laboratory staffed and equipped	Inspection	
e. Implementation of an IPM educational program	Trained personnel disseminating IPM materials	Inspection	
2. Research Grants	Year 1 2 3 4 5 0 3 9 15 20	IDIAP records Project Files	

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SUPPLEMENT I

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Life of Project:
From FY 79 to FY 84
Total U.S. Funding $7,000,000
Date Prepared:

Project Title & Number:

PAGE

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Outputs:	**Magnitude of Outputs:**		**Assumptions for achieving outputs:**
II. Institutional Development			
1. An expanded research staff of sufficient size to carry out a large scale research program.	Professional and technical staff size. Year 1 2 3 4 5 56 60 77 68 95	IDIAP personnel records	1. IDIAP can locate and hire sufficient professional and technical personnel to meet program requirements
2. An adequately trained professional research staff capable of implementing an area-focused production systems research program.	Provision of long-term training for 35 administrative, technical and scientific personnel and 500 person-months of short-term training. (See training schedule)	Project records	
	Production systems research being carried out in four areas by year one (end) and in eight areas by year three.		
3. An adequately equipped central headquarters facility operating in Santiago.	Central headquarters built and fully equipped. (See implementation plan for construction and equipment schedules).	Project records	

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AID 1020-28 (7-71)
SUPPLEMENT I

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Life of Project:
From FY 79 to FY 84
Total U.S. Funding $7,000,000
Date Prepared:

Project Title & Number:

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Inputs:	Implementation Target (Type and Quantity) Magnitude of Inputs AID / GOP		Assumptions for providing inputs:
1. Personnel	4336	1. Review of IDIAP's personnel and fiscal records and of project documentation.	1. IDIAP's budgetary requests are substantially fulfilled.
2. Commodities	2341 744		
3. Training	1315 100		
4. Technical Assistance	1510		2. Program implementation will occur in accordance with planning and budget projections.
5. Construction	1334 1250		
6. Other Costs	500 700		

5C(2) - PROJECT CHECKLIST

Listed below are, first, statutory criteria applicable generally to projects with FAA funds, and then project criteria applicable to individual fund sources: Development Assistance (with a sub-category for criteria applicable only to loans); and Security Supporting Assistance funds.

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

Country Checlist updated for Project No. 525-0207, Alternative Energy Sources. Standard Item Checklist has been reviewed for this Project.

A. GENERAL CRITERIA FOR PROJECT.

1.	App. Unnumbered; FAA Sec. 653(b); Sec. 671 (a) Describe how Committees on Appropriations of Senate and House have been or will be notified concerning the project; (b) is assistance within (Operational Year Budget) country or international organization allocation reported to Congress (or not more than $1 million over that figure	Congressional Notification sent July, 1979. No. Project was included as a shelf project in FY 1980 Congressional Presentation.
2.	FAA Sec. 611(a)(1). Prior to obligation in excess of $100,000, will there be (a) engineering, financial, and other plans necessary to carry out the assistance and (b) a reasonably firm estimate of the cost to the U.S. of the assistance?	Yes.
3.	FAA Sec. 611(a)(2). If further legislative action is required within recipient country, what is basis for reasonable expectation that such action will be completed in time to permit orderly accomplishment of purpose of the assistance?	None Required.
4.	FAA Sec. 611(b); App. Sec. 101. If for water or water-related land resource construction, has project met the standards and criteria as per *the Principles and Standards for Planning Water and Related Land Resources dated October 25, 1973?*	Not applicable.
5.	FAA Sec. 611(e). If project is capital assistance (e.g., construction), and all U.S. assistance for it will exceed $1 million, has Mission Director certified the country's capability effectively to maintain and utilize the project?	Yes.
6.	FAA Sec. 209, 619. Is project susceptible of execution as part of regional or multilateral project? If so why is project not so executed? Information and conclusion whether assistance will encourage regional development programs. If assistance is for newly independent country, is it furnished through multilateral organizations or plans to the maximum extent appropriate?	No. N/A

A

7. FAA Sec. 601(a); (and Sec. 201(f) for development loans). Information and conclusions whether project will encourage efforts of the country to: (a) increase the flow of international trade; (b) foster private initiative and competition; (c) encourage development and use of cooperatives, credit unions, and savings and loan associations; (d) discourage monopolistic practices; (e) improve technical efficiency of industry, agriculture and commerce; and (f) strengthen free labor unions.

a) Project may stimulate Panamanian exports;
b) Yes. Small farmers will be brought into market system;
c) Cooperatives will serve as a major vehicle to transmit new technologies to the small farm population;
d) Will promote small farm production;
e) Yes, agricultural efficiency;
f) Not applicable.

8. FAA Sec. 601(b). Information and conclusion on how project will encourage U.S. private trade and investment abroad and encourage private U.S. participation in foreign assistance programs (including use of private trade channels and the services of U.S. private enterprise).

Technical services and material and equipment inputs will be primarily U.S. origin.

9. FAA Sec. 612(b); Sec. 636(h). Describe steps taken to assure that, to the maximum extent possible, the country is contributing local currencies to meet the cost of contractual and other services, and foreign currencies owned by the U.S. are utilized to meet the cost of contractual and other services.

Not applicable.

10. FAA Sec. 612(d). Does the U.S. own excess foreign currency and, if so, what arrangements have been made for its release?

No.

11. FAA Sec. 601(e). Will the project utilize competitive selection procedures for the awarding of contracts, except where applicable procurement rules allow otherwise?

Yes.

12. FY 79 App. Act Sec. 608. If assistance is for the production of any commodity for export, is the commodity likely to be in surplus on world markets at the time the resulting productive capacity becomes operative, and is such assistance likely to cause substantial injury to U.S. producers of the same, similar, or competing commodity?

Technology development will focus on commodities produced for domestic consumption.

B. FUNDING CRITERIA FOR PROJECT

1. Development Assistance Project Criteria

a. FAA Sec. 102(c); Sec. 111; Sec. 281a. Extent to which activity will (a) effectively involve the poor in development, by extending access to economy at local level, increasing labor-intensive production, spreading investment out from cities to small towns and rural areas; and (b) help develop cooperatives, especially by technical assistance, to assist rural and urban poor to help themselves toward better life, and otherwise encourage democratic private and local governmental institutions?

Improved agricultural technologies directed at rural poor will result in their increased participation in the Panamanian economy. Labor intensive production technologies will be emphasized.

B1

b. FAA Sec. 103, 103A, 104, 105, 106, 107. Is assistance being made available: [include only applicable paragraph -- e.g., a, b, etc. -- which corresponds to source of funds used. If more than one fund source is used for project, include relevant paragraph for each fund source.] **103A**

(1) [103] for agriculture, rural development or nutrition; if so, extent to which activity is specifically designed to increase productivity and income of rural poor; [103A] if for agricultural research, is full account taken of needs of small farmers; **Yes**

(2) [104] for population planning or health; if so, extent to which activity extends low-cost, integrated delivery systems to provide health and family planning services, especially to rural areas and poor;

(3) [105] for education, public administration, or human resources development; if so, extent to which activity strengthens nonformal education, makes formal education more relevant, especially for rural families and urban poor, or strengthens management capability of institutions enabling the poor to participate in development;

(4) [106] for technical assistance, energy, research, reconstruction, and selected development problems; if so, extent activity is:

(a) technical cooperation and development, especially with U.S. private and voluntary, or regional and international development, organizations;

(b) to help alleviate energy problem;

(c) research into, and evaluation of, economic development processes and techniques;

(d) reconstruction after natural or manmade disaster;

(e) for special development problem, and to enable proper utilization of earlier U.S. infrastructure, etc., assistance;

(f) for programs of urban development, especially small labor-intensive enterprises, marketing systems, and financial or other institutions to help urban poor participate in economic and social development.

B1b

(5) [107] by grants for coordinated private effort to develop and disseminate intermediate technologies appropriate for developing countries.	
c. FAA Sec. 110(a); Sec. 208(e). Is the recipient country willing to contribute funds to the project, and in what manner has or will it provide assurances that it will provide at least 25% of the costs of the program, project, or activity with respect to which the assistance is to be furnished (or has the latter cost-sharing requirement been waived for a "relatively least-developed" country)?	Yes. Executing entity's operating budget has been increased 70% and investment budget 500% for FY 1979. Government's letter of application has made commitment for more than 50% counterpart financing.
d. FAA Sec. 110(b). Will grant capital assistance be disbursed for project over more than 3 years? If so, has justification satisfactory to Congress been made, and efforts for other financing, *or is the recipient country "relatively least developed"?*	Grant funds will be used only for acquisition of technical services.
e. FAA Sec. 207; Sec. 113. Extent to which assistance reflects appropriate emphasis on; (1) encouraging development of democratic, economic, political, and social institutions; (2) self-help in meeting the country's food needs; (3) improving availability of trained workerpower in the country; (4) programs designed to meet the country's health needs; (5) other important areas of economic, political, and social development, including industry; free labor unions, cooperatives, and Voluntary Agencies; transportation and communication; planning and public administration; urban development, and modernization of existing laws; or (6) integrating women into the recipient country's national economy.	Project will strengthen small farmer participation in economy and will result in a substantial increase in agricultural production, thus reducing dependence of agricultural imports.
f. FAA Sec. 281(b). Describe extent to which program recognizes the particular needs, desires, and capacities of the people of the country; utilizes the country's intellectual resources to encourage institutional development; and supports civic education and training in skills required for effective participation in governmental and political processes essential to self-government.	Project recognizes capacity of Panamanian small farmers to make a meaningful contribution to Panama's economic development.

B1

g. FAA Sec. 201(b)(2)-(4) and -(8); Sec. 201(e); Sec. 211(a)(1)-(3) and -(8). Does the activity give reasonable promise of contributing to the development of economic resources, or to the increase of productive capacities and self-sustaining economic growth; or of educational or other institutions directed toward social progress? Is it related to and consistent with other development activities, and will it contribute to realizable long-range objectives? And does project paper provide information and conclusion on an activity's economic and technical soundness?	Yes. Should increase productive capacity of Panamanian small farmers. Project is related to and consistent with other development activities and will contribute to long range objectives. Yes.
h. FAA Sec. 201(b)(6); Sec. 211(a)(5), (c). Information and conclusion on possible effects of the assistance on U.S. economy, with special reference to areas of substantial labor surplus, and extent to which U.S. commodities and assistance are furnished in a manner consistent with improving or safeguarding the U.S. balance-of-payments position.	No significant impact on U.S. economy is expected. Project's technical services and major part of project's commodities will be of U.S. origin.
2. Development Assistance Project Criteria (loans only)	
a. FAA Sec. 201(b)(1). Information and conclusion on availability of financing from other free-world sources, including private sources within U.S.	Financing for this project is not available from other free-world sources.
b. FAA Sec. 201(b)(2); 201(d). Information and conclusion on (1) capacity of the country to repay the loan, including reasonableness of repayment prospects, and (2) reasonableness and legality (under laws of country and U.S.) of lending and relending terms of the loan.	Panama has never defaulted on its international obligations. Repayment prospects are excellent. Loan terms are reasonable.
c. FAA Sec. 201(e). If loan is not made pursuant to a multilateral plan, and the amount of the loan exceeds $100,000, has country submitted to AID an application for such funds together with assurances to indicate that funds will be used in an economically and technically sound manner?	Yes.
d. FAA Sec. 201(f). Does project paper describe how project will promote the country's economic development taking into account the country's human and material resources requirements and relationship between ultimate objectives of the project and overall economic development?	Yes.

B2

e. FAA Sec. 202(a). Total amount of money under loan which is going directly to private enterprise, is going to intermediate credit institutions or other borrowers for use by private enterprise, is being used to finance imports from private sources, or is otherwise being used to finance procurements from private sources?	All construction and equipment (other than excess property) will go to private enterprise. Technical services may be procured from private sources. Total amount of loan funds to private enterprise will exceed $4,700.
f. FAA Sec. 620(d). If assistance is for any productive enterprise which will compete in the U.S. with U.S. enterprise, is there an agreement by the recipient country to prevent export to the U.S. of more than 20% of the enterprise's annual production during the life of the loan?	Project will focus on priority small farmer commodities destined primarily for the Panamanian market. The project will not directly contribute to productive enterprise which will compete directly with U.S. enterprise.
3. Project Criteria Solely for Security Supporting Assistance	
a. FAA Sec. 531. How will this assistance support promote economic or political stability?	N/A
b. FAA Sec. 533(c)(1). *Will assistance under the Southern African Special Requirements Fund be used for military, guerrilla, or paramilitary activities?*	
4. Additional Criteria for Alliance for Progress	
[Note: Alliance for Progress projects should add the following two items to a project checklist.]	
a. FAA Sec. 251(b)(1), -(8). Does assistance take into account principles of the Act of Bogota and the Charter of Punta del Este; and to what extent will the activity contribute to the economic or political integration of Latin America?	**Yes.**
b. FAA Sec. 251(b)(8); 251(n). For loans, has there been taken into account the effort made by recipient nation to repatriate capital invested in other countries by their own citizens? Is loan consistent with the findings and recommendations of the Inter-American Committee for the Alliance for Progress (now "CEPCIES," the Permanent Executive Committee of the OAS) in its annual review of national development activities?	N/A

Annex I
Exhibit C

CERTIFICATION PURSUANT TO SECTION 611(e) OF THE FOREIGN ASSISTANCE ACT OF 1961, AS AMENDED

I, Aldelmo Ruiz, the principal officer of the Agency for International Development in Panama, having taken into consideration among other factors, the maintenance and utilization of projects in Panama previously financed or assisted by the United States, do hereby certify that in my judgment Panama has the technical capability and the physical, financial, and human resources to utilize and maintain effectively the proposed loan/grant of seven million United States dollars ($7,000,000) from the Government of the United States of America to the Government of Panama for the development of a capacity to implement a program of applied agricultural research.

This judgment is based on the facts presented in this Project Paper and the Mission's previous experience with the Ministry of Planning and Economic Policy and the Panamanian Agricultural Research Institute, as well as loans to other agencies of the Government of Panama.

Aldelmo Ruiz
Director, USAID/Panama

Date: July 20, 1979

República de Panamá

Ministerio de Planificación y Política Económica

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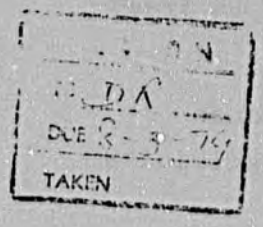
OFF	DIR	D/DIR	CONT	ECON	EXEC	DP	DR	TEAM	HRD	ENG	RCO	LMD	AAG	IIS	RHUDO	EMS	C&R		

Panamá, 19 de julio de 1979
121-DPEyS-DPS

Señor
Aidelmo Ruiz
Director de la Agencia
para el Desarrollo Internacional
E. S. D.



Señor Director:

Por este medio nuestro Gobierno solicita a la Agencia para el Desarrollo Internacional (AID), un préstamo por la suma de Seis Millones de Dólares de los Estados Unidos de América (U.S.$6,000,000.00) y una cooperación financiera no reembolsable por Un Millón de Dólares de los Estados Unidos de América (U.S.$1,000,000.00), para el financiamiento de un Proyecto de Desarrollo de Tecnología Agropecuaria.

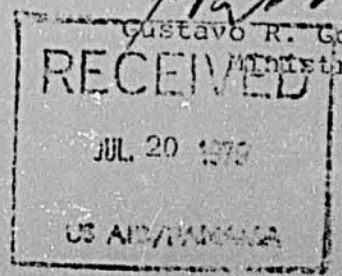
El Instituto de Investigación Agropecuaria de Panamá (IDIAP), administraría la ejecución del proyecto que habría de realizarse en un período de 5 años.

El proyecto tiene como objetivos fortalecer la capacidad del Gobierno Nacional para realizar investigaciones cuyos resultados sean adoptados a nivel de finca e iniciar la ejecución de investigaciones orientadas hacia los productores, en 8 áreas prioritarias del país.

Adjunto le enviamos un cuadro resumen del proyecto, con indicación de los componentes y sus respectivas estimaciones de costo y fuentes de financiamiento.

Atentamente,

Gustavo R. González
Ministro



Adj.: lo indicado

PROYECTO DE DESARROLLO DE TECNOLOGIA AGROPECUARIA

PLAN FINANCIERO

(En miles de dólares)

Detalle	Fuente de Financiamiento: Préstamo	Coop. Financ. No reembolsable	Aporte Local	Total
I. Investigación en áreas seleccionadas	2,994	1,000	5,615	9,609
Construcciones	451	-	360	811
Equipo y materiales	1,411	-	366	1,777
Vehículos	422	-	213	635
Asistencia técnica	210	1,000	-	1,210
Gastos de Operación	-	-	4,676	4,676
Investigación complementaria	500	-	-	500
II. Fortalecimiento Institucional	3,006	-	1,385	4,391
Construcciones	883	-	890	1,773
Equipo y materiales	473	-	118	591
Vehículos	-	-	47	47
Asistencia técnica	300	-	-	300
Entrenamiento	1,350	-	100	1,450
Gastos de operación	-	-	230	230
TOTAL	6,000	1,000	7,000	14,000

PROJECT AUTHORIZATION AND REQUEST FOR ALLOTMENT OF FUNDS

Name of Country:	Panama
Name of Project:	Agricultural Technology Development
Project Number:	525-0180
Loan Number:	525-T-050

Pursuant to Part I, Chapter I, Section 103 of the Foreign Assistance Act of 1961, as amended, I hereby authorize a Loan and a Grant to the Government of Panama (the "Cooperating Country") of not to exceed Seven Million United States Dollars (U.S. $7,000,000) to assist in financing certain foreign exchange and local currency costs of goods and services required for the Project as described in the following paragraph.

The Project consists of institutional development activities designed to improve and expand the capability of the Panamanian Agricultural Research Institute (IDIAP) to plan and carry out an applied agricultural research program, and applied agricultural research and dissemination activities in selected geographic areas of Panama (hereinafter referred to as the "Project").

Of the authorized amount, Six Million dollars ($6,000,000) ("Loan") will be loaned to the Cooperating Country to assist in financing certain Foreign Exchange and local currency cost of goods and services required for the Project. The entire amount of the A.I.D. financing herein authorized for the Project will be obligated when the Project Agreement is executed.

I hereby authorize the initiation of negotiation and execution of the Project Agreement by the Officer to whom such authority has been delegated in accordance with A.I.D. regulations and Delegations of Authority subject to the following essential terms and covenants and major conditions; together with such other terms and conditions as A.I.D. may deem appropriate:

A. Interest Rate and Terms of Repayment

The Cooperating Country shall repay the Loan to A.I.D. in United States Dollars within twenty (20) years from the date of first disbursement of the Loan, including a grace period of not to exceed ten (10) years. The Cooperating Country shall pay to A.I.D. in United States Dollars interest from the date of first disbursement of the Loan at the rate of (a) two percent (2%) per annum during the first ten (10) years, and (b) three percent (3%) per annum thereafter, on the outstanding disbursed balance of the Loan and on any due and unpaid interest accrued thereon.

B. Source and Origin of Goods and Services

Except for ocean shipping and Grant-financed technical assistance, goods and services financed by A.I.D. under the Project shall have their source and origin in the Cooperating Country or in countries located in A.I.D. Geographic Code 941 except as A.I.D. may otherwise agree in writing. Ocean shipping financed under the Loan shall be procured in the United States or the Cooperating Country. Grant-financed goods and services shall be procured in the United States.

C. Conditions Precedent to Initial Disbursement

Prior to any disbursement, or to the issuance of any commitment documents under the Project Agreement, the Cooperating Country shall furnish in form and substance satisfactory to A.I.D.:

1. An opinion of a legal representative of the Cooperating Country acceptable to A.I.D. that the Project Agreement has been duly authorized and/or ratified by the Cooperating Country and executed on its behalf and that it constitutes a valid and legally binding obligation of the Cooperating Country in accordance with all of its terms;

2. A statement and specimen signature of the person or persons acting as a representative of the Cooperating Country for purposes of the Project Agreement; and

3. A detailed implementation plan for the first year of the Project that provides a schedule for the procurement of Project inputs including technical assistance, training and commodities, that outlines the Cooperating Country actions required prior to utilization of the Project inputs and that contains a description of how these inputs will contribute to Project activities.

D. Conditions Precedent to Disbursement for Field Activities in each Geographic Area

1. Prior to any disbursement, or to the issuance of any commitment documents under the Project Agreement for field research and validation trials in each geographic area, the Cooperating Country shall furnish in form and substance satisfactory to A.I.D.: (1) Evidence that required diagnostic studies have been completed and analyzed and a research plan developed for that area which shall include an analysis of the need for complementary inputs and a description of the arrangements for obtaining them; (2) A plan from the Ministry of Agricultural Development which describes the role, personnel and other

contributions of each institution that will be involved in the dissemination of research results to Panamanian small farmers including a plan for the participation and training of Ministry of Agricultural Development personnel in this activity; and (3) A detailed plan for the use of long-term technical assistance in carrying out the research activities and evidence that arrangements have been made to obtain the technical services specified in the plan.

E. Covenants

Prior to the procurement or use of any pesticide financed under this Agreement, the GOP and AID/Panama will confer regarding the proposed procurement or use of the pesticide and will jointly prepare and describe in writing a plan as to how the pesticide will be used and the safeguards to be followed.

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ACTION COPY

ACTION TAKEN_____

DATE_____INITIALS_____

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VV PN0303
PP RUEHZP
DE RUEHC #9280/1 2730128
ZNR UUUUU ZZH
P 2923337 SEP 78
FM SECSTATE WASHDC
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BT
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29 SEP 78
TOR: 0150
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ACTION: AID
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AIDAC

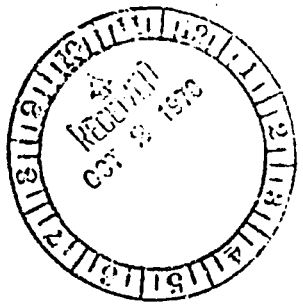
E.O. 11652: N/A

TAGS:

SUBJECT: GUIDANCE CABLE FOR APPLIED AGRICULTURAL RESEARCH PROJECT-INTERIM REPORT - PANAMA

THE SUBJECT INTERIM REPORT WAS REVIEWED ON AUGUST 18, 1978 AND APPROVED BY THE DAEC. IN PREPARING THE PP, THE FOLLOWING ISSUES AND CONCERNS SHOULD BE TAKEN INTO CONSIDERATION:

--1. GOP POLICY ENVIRONMENT. CONCERN WAS EXPRESSED AT THE DAEC OVER THE GOP'S COMMITMENT TO PROVIDE BOTH POLICY AND BUDGETARY SUPPORT TO AGRICULTURAL RESEARCH DIRECTED AT THE NEEDS OF THE SMALL PRODUCERS. FURTHERMORE, IT WAS QUESTIONED WHETHER THE CURRENT GOP POLICY ENVIRONMENT IS CONDUCIVE TO PROMOTING CHANGES IN PRODUCTION AND PRICING, THEREBY ENABLING THE SMALL PRODUCER TO TAKE ADVANTAGE OF IMPROVED TECHNOLOGIES RESULTING FROM RESEARCH ACTIVITIES. IT WAS NOTED THAT THE CURRENT GOP SUPPORT PRICES FOR MILK AND BEEF HAVE BEEN HELD ARTIFICIALLY LOW, WHICH COULD ACT AS A DISINCENTIVE TO SMALL FARMER PRODUCTION OF CATTLE AND BEEF FOR THE DOMESTIC MARKET. THE PP SHOULD THEREFORE DESCRIBE THE EXTENT TO WHICH RESEARCH HAS BEEN IDENTIFIED AS A MAJOR CONSTRAINT TO AGRICULTURAL PRODUCTION



AND PRODUCTIVITY IN PANAMA, AND HOW THIS PROJECT PROPOSES TO OVERCOME THESE CONSTRAINTS. TO DEMONSTRATE THE LINKAGE BETWEEN THE PROPOSED RESEARCH AND THE TARGET GROUP, THE PP SHOULD PRESENT A PROFILE OF THE TARGET FARMER, INCLUDING INCOME, FARM SIZE, CROPPING PATTERNS BY FARM SIZE, ETC. SAFEGUARDS SHOULD THEN BE DEVELOPED TO ENSURE THAT RESEARCH WILL BE SMALL-FARMER ORIENTED.

GOP COMMITMENT TO THIS ACTIVITY SHOULD BE DEMONSTRATED THROUGH PROGRAMMED BUDGETARY ALLOCATIONS WHICH INCLUDE INCENTIVES TO KEEP HIGHLY QUALIFIED TECHNICIANS ON IDIAP'S STAFF. THE PP SHOULD ALSO IDENTIFY MINIMUM POLICY CHANGES NECESSARY TO MAKE THE RESEARCH PROGRAM EFFECTIVE AND DESCRIBE THE EXPECTED IMPACT OF THESE POLICIES ON PROPOSED RESEARCH ACTIVITIES AND THE PROJECT PURPOSE. IT IS SUGGESTED THAT A STUDY OF THE IMPACT OF PRICING POLICIES MIGHT BE INCLUDED AS A RESEARCH ACTIVITY TO BE FUNDED UNDER THIS PROJECT.

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--2. BASELINE INFORMATION GATHERING. THE IR INDICATES THAT DIAGNOSTIC STUDIES WILL BE UNDERTAKEN THROUGH AN INFORMAL GATHERING SYSTEM IN PRESELECTED AREAS. SINCE PANAMA IS PARTICIPATING IN A ROCAP/IICA SPONSORED PROGRAM TO GENERATE BASELINE DATE USING SAMPLE FRAME SURVEY TECHNIQUES, IT IS SUGGESTED THAT THE MISSION EXPLORE THE POSSIBILITIES OF INCORPORATING THE SAMPLE FRAME METHODOLOGY AS PART OF THIS PROJECT. IT IS ALSO SUGGESTED THAT THE MISSION CONSIDER INCLUDING A SOCIAL SCIENTIST IN THE IDIAP TRAINING PROGRAM TO WORK WITH SURVEYORS IN DOING THE BASELINE STUDY.

--3. INSTITUTIONAL CAPACITY. KEY TO THE SUCCESS OF THIS PROJECT IS THE NEED FOR A CONTINUOUS OUTREACH SYSTEM WHICH LINKS IDIAP RESEARCH TO ACTUAL PRODUCTION ACTIVITIES IN THE FIELD. THE PP SHOULD, THEREFORE, DESCRIBE THE ROLES OF IDIAP AND MIDA IN EXTENSION OUTREACH AS WELL AS THE CURRENT OR PROPOSED ROLES OF THE AGRICULTURAL COOPERATIVE FEDERATION (COACROL), THE AGRICULTURAL DEVELOPMENT BANK (BDA), AND OTHER ORGANIZATIONS PROVIDING EXTENSION SERVICES. THE INSTITUTIONAL CAPACITY AND COORDINATION MECHANISMS FOR IDIAP AND MIDA TO DISSEMINATE RESEARCH FINDINGS TO UP TO 10,000 SMALL FARMERS SHOULD BE ANALYZED. IF SUFFICIENT EXTENSION CAPACITY TO ADEQUATELY DISSEMINATE INFORMATION TO THE TARGET GROUP DOES NOT PRESENTLY EXIST, THE MISSION SHOULD CONSIDER SUBMITTING A PID FOR FUTURE FUNDING TO IMPROVE PANAMANIAN EXTENSION CAPABILITIES. AS AN ALTERNATIVE, THE MISSION MIGHT WISH TO EXPLORE WITH THE GOP OTHER COST EFFECTIVE,

INNOVATIVE WAYS OF PROVIDING EXTENSION SERVICES.

--4. RESEARCH COORDINATION. IT WAS NOTED THAT IDIAP IS COLLABORATING OR HAS WORKING AGREEMENTS WITH THE MAJOR INTERNATIONAL RESEARCH INSTITUTES. HOWEVER, NATIONAL RESEARCH INSTITUTES IN OTHER CENTRAL AMERICAN COUNTRIES ARE ALSO CARRYING OUT PROGRAMS, OR ADAPTING RESEARCH ACTIVITIES OF REGIONAL INSTITUTIONS TO LOCAL CONDITIONS. THE PP SHOULD EXAMINE THE FUNCTIONAL LINKAGES BETWEEN THE PROPOSED RESEARCH EFFORT, AND THE INTERNATIONAL ORGANIZATIONS AS WELL AS BETWEEN IDIAP AND THE CENTRAL AMERICAN NATIONAL INSTITUTES. IT IS SUGGESTED THAT INTERCHANGE VISITS WITH OTHER CENTRAL AMERICAN RESEARCH INSTITUTES MIGHT BE CONSIDERED FOR FUNDING IN THE PP. MISSION SHOULD BE AWARE THAT A STUDY ON AGRICULTURAL

CENTRAL AMERICA IS PROPOSED FOR FUNDING UNDER THE ROCAP AG RESEARCH AND INFORMATION PROJECT.

--5. RESEARCH ORIENTATION. THE PP SHOULD DESCRIBE THE RELATIONSHIP OF RESEARCH ACTIVITIES CARRIED OUT BY THE FACULTY OF AGRONOMY OF THE UNIVERSITY OF PANAMA AND PRO-

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POSLD RESEARCH ACTIVITIES AT IDIAP. DURING PP PREPARATION A ROLE FOR THE FA SHOULD BE EXPLORED IN THIS PROJECT IN ORDER TO MAKE OPTIMUM USE OF PANAMA'S ENTIRE RESEARCH CAPABILITIES AS WELL AS TO INVOLVE UNIVERSITY FACULTY AND STUDENTS IN RESEARCH RELEVANT TO SMALL-SCALE PRODUCTION SYSTEMS.

--6. SOCIAL ANALYSIS. IN ADDITION TO ESTABLISHING LEVELS OF POVERTY OF THE RECIPIENT POPULATION(S) THE PP SHOULD ANALYZE REAL AND/OR POTENTIAL SOCIAL CONSTRAINTS TO SUCCESSFUL PROJECT IMPLEMENTATION: (1) RISK MANAGEMENT BEHAVIOR OF RECIPIENTS IN THE CONTEXT OF NEW TECHNOLOGY ADOPTION; (2) SOPHISTICATION LEVEL OF RECIPIENTS VIS-A-VIS THAT OF TECHNOLOGY TO BE INTRODUCED; (3) COST OF INPUTS IN RELATION TO SMALL FARMER INCOME; AND (4) SOCIAL DISTANCE BETWEEN RECIPIENTS AND RESEARCHERS AND/OR EXTENSIONISTS. PROJECT DESIGN SHOULD THEN INCLUDE A STRATEGY TO DEAL WITH IDENTIFIED CONSTRAINTS.

--7. ECONOMIC ANALYSIS. IT IS SUGGESTED THAT THE FARM BUDGET APPROACH (WITH AND WITHOUT THIS PROJECT) BE USED TO DETERMINE THE IMPACT OF THE RESEARCH PROJECTS ON TYPICAL SMALL FARMERS. ILLUSTRATIVE FARM BUDGETS SHOULD TYPICAL SMALL FARMERS. ILLUSTRATIVE FARM BUDGETS SHOULD BE USED TO SHOW (1) THE FINANCIAL FEASIBILITY OF FARMERS ADOPTING NEW TECHNOLOGIES RESULTING FROM RESEARCH PROGRAM; AND (2) THE ESTIMATED RATE OF RETURN FOR THE PROJECT AS A WHOLE. LEAST COST ANALYSIS SHOULD THEN BE APPLIED TO DEMONSTRATE THE COST EFFECTIVENESS OF THE PROPOSED RESEARCH DISSEMINATION MECHANISM TO BE ADOPTED FOR THIS PROJECT AS COMPARED TO OTHER POSSIBLE ALTERNATIVES.

--8. PEST MANAGEMENT.

----A. IF ANY PESTICIDES ARE PROPOSED FOR USE, THE IEE SHOULD BE PREPARED IN ACCORDANCE WITH ENVIRONMENTAL GUIDELINES FOUND IN AID REG. 16, SECTION 216.3(B) PESTICIDE PROCEDURES. THAT PORTION OF THE PROCEDURES FOR PESTICIDE PROCUREMENT FOR RESEARCH OR LIMITED FIELD EVALUATION FOUND IN SECTION 216.3 (B) (2) (III) IS PERTINENT.

----B. AS STATED IN AID POLICY ON PESTICIDE SUPPORT, AN INTEGRATED PEST MANAGEMENT PROGRAM SHOULD BE CONSIDERED IN DESIGNING RESEARCH PROGRAMS FOR PEST CONTROL. THE MISSION IS URGED TO CONSIDER THE ADDITION OF A TECHNICAL ASSISTANCE COMPONENT TO THE PROJECT FOR THE PURPOSE OF DEVELOPING THE PEST MANAGEMENT CONCEPT AS PART OF IDIAP'S AGRICULTURAL RESEARCH EFFORTS.

--9. TITLE XII. THE POSSIBLE ROLE FOR TITLE XII UNIVERSITIES IN THIS PROJECT SHOULD BE EXPLORED AND DISCUSSED IN THE PP. CHRISTOPHER
BT
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MAJOR SOILS CLASSIFICATIONS OF PANAMA

Despite recent expansions of the crop area in Panama a sizeable proportion of the plains is still taken up by grazing land carved out from the original forest and covered with faragua grass. Because of its tropical formation and frequent burning over, the topsoil mantle is usually thin and unstable and must be treated with a great deal of care to avoid irreversible erosion. The higher altitude non-volcanic soils in this zone are unsuited for agriculture because they are very susceptible to leaching and erosion.

Eighteen percent of the land area is classified as a "premontane wet forest" life zone. This is found mostly on the Pacific side and is not considered apt for most agriculture, with the exception of the volcanic soils in the higher altitude of Chiriqui. These latter areas are some of the most productive agricultural regions, where coffee, fruits, vegetables, and milk are produced profitably. About one-fourth of the rest of this zone may be suitable only for bananas and plantains. Nevertheless, much of it has been colonized and is in private hands. Serious soil degradation has occured in this area.

Nearly 1.1 million hectares - over 13 percent of the land area - are classified as "tropical wet forest" and are mostly still forest covered. The bulk of this zone is on the Atlantic slope, with other portions found along the coastal areas of Veraguas province and northern Chiriqui. There are sound ecological reasons why human settlement has been limited to the Pacific watershed. As in the rest of Central America, the Atlantic side is extremely humid, with annual rainfall of 3,000 mm or more and no pronounced dry season.

There are also sound ecological reasons why much of the hills and mountains of the Pacific slope should have remained in forests. The subsistence needs of a growing rural population have led to an indiscriminate cutting of primary forest, mostly during the present century. This has exposed a wide band of land, approximately 12,000 square kilometers, or 16 percent of the total land area, to erosion ranging from serious to irreversible. This band begins just west of Panama City and extends to Tolé, at the western end of the Azuero Peninsula. At least 500,000 has. of land presently in "farms" are estimated to be concerned.

While the Atlantic (North) coast is generally considered too humid for most field crops - and perhaps for cattle as well- the Pacific (South) side has a very pronounced dry season from December through April which is in some areas accompanied by hot dry winds.

On the other hand, the high rainfall during the wet season (a minimum average of 1,000 mm even in the driest zones), its concentration in the form of heavy afternoon and evening showers and the extremely high relative humidity impose other limitations. The major problems are heavy runoffs on sloping land (especially where forest cover has been destoryed), waterlogging of flat land, and insects and plant diseases. A favorable "moisture balance" in the soils of most of this region is found for only about one month each during the early and late periods of the rainy season. 1/ These ecological conditions accentuate the need for good soil management if the land is to be used productively.

Overall it is estimated that only about one-fourth of the total land (or about 1.5 million hectares) is suitable for crops and that only about one half of this area is unquestionably suitable for mechanized field crops. This includes the two narrow parallel strips around the Gulf of Parita on the Pacific coast and running along the eastern shore of the Azuero Peninsula.

This region appears to have a more favorable moisture balance than other areas because of less intensive rains and is more heavily cropped than any plains regions outside Chiriqui. But the full realization of its agronomic potential requires supplemental irrigation as already practiced on sugar cane.

1/ Reliable soil (mostly reconnoisance) and rainfall data exist for only about one-third of the country - roughly the western Pacific watershed. For virtually the entire Atlantic side (with the exception of a narrow strip on both sides of Lake Gatun), as well as the eastern part of the country from about Chepo in Panama province to the border with Colombia, and two thirds of the Azuero Peninsula, there are only scanty climatic data, and soil and native vegetation information is based almost solely on aerial reconnaissance at a scale of 1:250,000. Generalizations regarding the agricultural potential of the Atlantic slope and of the western jungles are thus at best preliminary.

TABLE I

INDEX OF PRICE SUPPORTS AND PRODUCTION OF MAIN STAPLES, PANAMA, 1973 - 1978

(1973 = 100)

Year	Rice		Corn		Beans	
	Price Support	Production	Price Support	Production	Price Support	Production
1973	100	100	100	100	100	100
1974	116	133	111	103	150	114
1975	166	145	188	103	300	149
1976	175	130	188	103	300	94
1977	175	102	188	92	300	94
1978 a/	175	131	188	114	300	114

Source: MIDA and Panama en Cifras

a/ Production figures estimated.

TABLE 2

INDEX OF CREDIT AND PRODUCTION CREDIT FOR MAIN STAPLES, PANAMA, 1970 - 1978

(1973 = 100)

Year	Rice		Corn		Beans	
	Credit	Production	Credit	Production	Credit	Production
1973	100	100	100	100	100	100
1974	190	133	235	103	508	114
1975	202	145	260	103	398	149
1976	198	130	362	103	854	94
1977	103	102	285	92	122	94
1978 a/	124	131	200	114	136	114

Source: MIDA and Panama en Cifras.

a/ Credit and Production figures estimated.

TABLE 3

PROJECTIONS OF PRODUCTION AND CONSUMPTION OF MAIN STAPLES, PANAMA, 1979, 1980 AND 1985.

(000 MT)

Year	Corn			Beans		
	Production	Consumption	Balance	Production	Consumption	Balance
1979	76.7	98.4	21.7	3.6	5.8	2.2
1980	78.4	101.7	23.3	3.7	6.0	2.3
1985	86.9	120.2	33.3	4.2	6.9	2.7

Source: Panama en Cifras and Hoja de Balance de Alimentos.

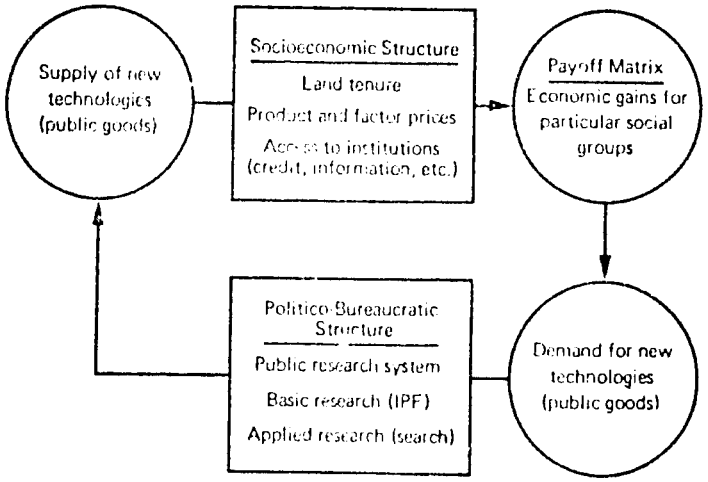
TABLE 4

AVERAGE YIELDS OF SELECTED CROPS IN PANAMA AND CENTRAL AMERICA, 1974-76

	Corn	Rice	Sorghum	Beans	Sugar-Cane
	(Metric tons/hectare)				
Panama	0.76	1.44	--	0.27	47.4
Costa Rica	1.31	1.63	1.86	0.45	59.7
El Salvador	1.75	3.35	1.22	0.69	67.5
Guatemala	1.30	1.77	1.27	0.67	63.9
Honduras	1.11	1.22	1.15	0.76	40.2
Nicaragua	0.85	1.93	1.00	0.76	61.4

Source: Agricultural Research and Farmer Advisory Services in Central America and Panama, Tripartite Study Team, 1978.

The Inducement and Diffusion of Technological Change



Source: Based on Alain de Janvry, "The Organization and Productivity of National Research Systems" ADC/RTN Conference on Resource Allocation in National and International Agricultural Research, Airlie House, Virginia, January 26-29, 1975.

SUMMARY OF DIRECT COST - BENEFIT - STUDIES OF AGRICULTURAL RESEARCH

Study	Country	Commodity	Time Period	Annual Internal Rate of Return (%)
Griliches (1958)	U.S.A.	Hybrid corn	1940-1955	35-40
Griliches (1958)	U.S.A.	Hybrid Sorghum	1940-1957	(20)
Peterson (1966)	U.S.A.	Poultry	1915-1960	21-25
Ardito Barletta (1970)	Mexico	Wheat	1943-1963	90
Ardito Barletta (1970)	Mexico	Maize	1943-1963	35
Evenson (1969)	S.Africa	Sugarcane	1945-1962	40
Ayer (1970)	Brazil	Cotton	1924-1967	77+
*Hertford, Ardila, Roches and Trujillo (1975)	Colombia	Rice	1957-1972	60-82
	Colombia	Soybeans	1960-1971	79-96
	Colombia	Cotton	1953-1972	None
*Peterson and Fitzharris (1975)	U.S.A.	aggregate	1937-1942	50
			1947-1952	51
			1957-1962	49
			1967-1972	34

Source: * From papers presented at ADC/RTN Conference on Resources Allocation and Productivity in National and International Agricultural Research, Airlie House, Virginia, January 26-29, 1975.

AGRICULTURAL RESEARCH AND EXTENSION - 1965 - COMPARATIVE STATISTICS

Region	Expenditures as percent of value of Agricultural Production		Expenditures per farm		Scientists (man-year) per $10M Value of Agricultural Production	Extension Workers		Expenditures per	
	Research	Extension	Research	Extension		Per $10M Agri. Prod.	Per Thousand farms	Scientist	Extension Worker
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
North America	1.01	.53	93.11	48.78	3.97	2.38	2.18	25.53	22.37
Northern Europe	.93	.53	32.55	16.74	4.03	8.56	2.66	23.08	6.39
Southern Europe	.36	.41	2.44	2.51	3.68	8.77	.54	10.33	4.70
Oceania, S. Africa & Rhodesia	1.61	(.80)	188.88	(93.68)	6.82	14.75	(17.32)	23.62	(5.41)
Eastern Europe & U.S.S.R.	.64	(.39)	7.49	(4.62)	4.09	9.16	(1.07)	15.20	(4.31)
Latin America	.17	.19	1.57	1.75	2.01	3.22	.30	8.47	5.89
Middle East & North Africa	.55	(.55)	4.88	(4.83)	2.68	25.87	(2.27)	20.71	(2.13)
South & S.E. Asia	.24	.31	.43	.55	2.81	19.26	.35	8.53	(1.59)
East Asia	.79	.57	7.15	5.16	6.24	22.17	2.01	18.64	2.57
Sub-Sahara Africa	.45	.38	2.79	2.33	1.81	32.15	1.93	24.93	1.13
Developed Countries	.874	.496	17.25	9.78	4.37	7.74	1.53	20.01	8.40
Less Developed Countries	.259	.289	1.07	1.19	2.11	15.66	.64	12.29	1.84

AGRICULTURAL MARKETING STRUCTURES FOR MAJOR SMALL FARM PRODUCTS.

A. Market Structures

In order to obtain an adequate insight into Panama's agricultural marketing system, the general marketing flows as well as government pricing policies and end-uses determination were studied for major commodity groups. These commodity groups included grains (rice, corn), edible beans, perishables (tomatoes, potatoes, onions), and livestock and animal products (beef, milk, poultry and eggs). Some commodities were excluded from the study for different reasons. Sugar-cane was dropped due to the specialized contract operation it is grown under and the nature of its processing.

Soybean production at present, is still somewhat experimental and, as yet, it is not a commercial crop. Sorghum, though not specifically omitted, follows the same marketing flow as corn for animal feed and little is known about its production potential at this time.

Marketing flow diagrams showing structure, participants, volumes (whenever possible), and end-use of commodities have been developed for most priority crops. The results of these analyses are incorporated in the text that follows.

1. Grains

The two major traditional crops within this category are rice and corn. Rice production seems to be at a self-sufficiency point, but corn still is a deficit crop. However, both have marketing problems in terms of available and adequate storage facilities, especially storage capacity supplied or to be supplied by the Agricultural Marketing Institute (IMA).

a. Rice

Rice is characterized by a well-defined but complex marketing structure and flow. The product changes its form as it is milled and may be stored for long time periods. Private industry is the largest component within the marketing chain purchasing over 80% of the crop available for sale off the farm. This rice is also milled by private sector mills. IMA purchases about one-fifth of marketed production. Almost 25 percent of total consumption is consumed on farm.

b. Corn

The marketing channels are as complex as those for rice and involve processing and storage. On-farm consumption of corn amounts to fully two-thirds of total production. About one-third of production enters marketing channels of which one-third is purchased by IMA; the difference goes through private channels. Beyond the first stage of marketing, very little accurate information is available about the volumes used for different end-uses, although corn is used for human consumption such as corn flour and for animal feed.

2. Edible Beans

Beans have a less complicated marketing structure than grains. No processing changes, such as milling, take place. IMA handles one-half of the crop available for sale. The remainder of sales goes through trucker-merchant-wholesalers, wholesalers and retailers as well as a few vertically integrated producers. On-farm consumption utilizes 55 percent of total production. No reliable figures are available concerning end uses after the first marketing stage.

3. Perishables

This group of priority commodities consists of tomatoes (including industrial tomatoes), onions, and potatoes. In general, their marketing channels are simpler than grains and beans, and, except for industrial tomatoes, all perishables are consumed without processing. In spite of simple marketing channels, post-harvest losses are heavy, ranging from at least 15% to around 30%. Such losses are due to lack of adequate cold storage facilities, lack of grading and classifications and improper handling.

a. Tomatoes

This commodity is split into two groups, table and industrial tomatoes. While industrial tomatoes (65 percent of production) are produced under contract and handled through totally private channels, table tomatoes are channeled through both private and government facilities with IMA purchasing less than 4 percent of total production. Heavy losses are incurred while in storage at wholesale and retail levels. According to IMA, about 57 percent of the processed industrial tomatoes is

being exported.

b. Potatoes

Perhaps the simplest marketing structure of all priority commodities exists for potatoes. Potatoes are grown within a limited area and marketed through the "Junta de Comercialización de Papas" to trucker-merchant-wholesalers and then to retailers. This Junta controls over 90 percent of the potatoes marketed with about 4 percent being bought by IMA. The Junta controls supply which in turn influences prices received by its members. Potatoes are currently not being processed.

c. Onions

The market structure for onions, a very perishable commodity, is heavily influenced by IMA's participation. IMA purchases one-half of the annual crop. The other half is marketed principally through trucker-merchant-wholesalers, to retailers. Like tomatoes and potatoes this crop suffers from heavy post-harvest losses due to inadequate infrastructure. Onions are consumed fresh without any secondary uses. About one-half of the onions consumed in Panama are imported and IMA purchases virtually all imported onions.

4. Livestock and Livestock Products

This priority commodity group includes beef, pork, poultry, eggs, milk, and milk by-products. Marketing channels for these commodities and adequacy of marketing infrastructures vary from one commodity to another. Among the major deficiencies are the lack of adequate cold storage for broilers and eggs and poor handling of fresh milk.

a. Beef

Beef is marketed through uncomplicated channels beginning with federal, municipal, and private slaughter houses and then to wholesalers and retailers. Most beef is consumed as fresh meat with about 5 percent being exported. By-products such as bone and blood meal are being used in the animal feed industry while the hides are used for leather goods and exports.

b. Poultry and Eggs

This subgroup of priority commodities has one of

the most developed marketing structures. It is composed of a totally vertically-integrated industry dominated by three firms. These firms together control 90 percent of the business ranging from raw input production such as sorghum, to incubators, feed production, slaughter houses, wholesaling and retailing. The other 10 percent is produced by small individual firms which depend on the big three for their inputs and outlets. Poultry is consumed fresh except in the interior of the country where it is shipped in a frozen state. Eggs are consumed fresh except for a small quantity processed into mayonnaise.

Although there evidently exists a considerable volume of small scale poultry and egg production for home consumtion and for local markets, no accurate information is available.

c. Milk and Milk Products

Milk production is characterized by a few large dairies producing grade A milk and many small units producing lower grade milk. Milk is processed by a few processors who distribute their products through retailers. About a quarter of milk production is sold by the farmer directly to consumer, and about one-third of production is made into evaporated, condensed and dry whole milk; another one-third is packaged and sold as fluid milk. A small amount of condensed milk is exported to Costa Rica.

B. Government Pricing

Pricing actions by government encompass all agricultural commodity and processed product prices, including farmgate, wholesale, and retail prices. The price series included herein generally refer to the major products available in the market place.

1. Farm-Gate Prices

Tables 1 and 3 of Annex II, Exhibit B show farm support prices and average prices received by farmers, respectively. Diagrams of the movement and relationship of prices for selected products over five years (1973-1977) revealed the following:

a. the relative changes in farm and retail prices of rice, corn, onions,beans and cassava left margins virtually unchanged;

b. the farm-retail margin for milk, eggs, poultry, meat and tomatoes declined considerably and;

c. the farm-retail margin for potatoes increased slightly.

2. Wholesale Prices

Over the 1973-77 period the wholesale food price under index climbed 66 percent while the retail food price index increased only 41 percent.

3. Retail Prices

Table 2 of Annex II, Exhibit B contains average annual retail prices for Panama City.

4. Conclusion

Limited price data forces a very broad sweeping evaluation of price effects. The wide divergency in the movements in index numbers indicates a slight narrowing of the wholesale-retail margins. One cannot ascertain the correctness of this price action from available data. It may be that this type of action will tend to drive some participants from the market place. On the other hand, it may indicate that margins were excessive before and actually result in a savings in marketing costs.

C. Interaction of the Proposed IDIAP Program and the Market System.

According to IDIAP's National Plan for generation, adoption and transfer of appropriate technology, the central objective is to "satisfy to the highest possible degree the requirement of the population and to create conditions for the population to receive the benefit from such development".

Among other specific objectives, this goal is to be achieved by "adjusting production organizations to be compatible with reality....which would allow for the marginal farmer to be incorporated into modern production systems". A central purpose of IDIAP's project is to increase the income level of small and marginal farmers by the application and adaptation of appropriate technology. It is expected that this group of targeted beneficiaries will be introduced into the marketing system as levels of production increase. This will require an adequate commercial marketing system and equitable prices if real productivity is to be increased.

Due to the small population of this country the domestic market for some agricultural commodities will be small unless augmented by development of export markets or changes in consumption patterns. Furthermore, while rising per-capita income will increase food demand, a declining rate of population increase (now down to about 2.5 percent annually) will limit expansion of

the internal market.

D. Analysis of Agricultural Marketing Structures on Possible Increases in Production of Priority Commodities by Small Farmers.

Current marketing structures, government pricing policies, and current and potential end-uses are all factors which serve as incentives or disencentives to increased production of priority commodities by small farmers. The possible impact of these factors is analyzed for each major commodity group.

1. Grains and Edible Beans

a. Current Marketing Structures

The current marketing structure indicates that the market flow of grains and edible beans is complex. These products are supported by IMA which is expected to (1) guarantee prices to producers, (2) stand ready to purchase everything offered to it at established prices, and (3) be able to adequately store all amounts delivered to it. In addition, private traders and vertically integrated producers are involved in the market. It is expected that the supporting actions by IMA will act as an incentive to the small farmer by allowing him an alternative outlet for his products.

b. Government Pricing Policies

Section B summarizes the historical support prices for corn and rice, the principal staples. When the historical support prices for these two commodities are compared with the acreage planted a high positive correlation between these two variables is evident. The adjustment of farm support prices upward for rice and corn has resulted in the doubling of small farm acreage planted to these two commodities as compared to large farms. In a similar and more significant manner, non-machine planted acreage has responded 6 times as fast to increases in farm support price than machine planted acreage. Therefore, since the additional acreage has been a response of some combination of small farmer and traditional farming methods to price support increases, it can be assumed that the target farmer is responsive to market influences.

This relationship between acreage planted and price support increases does not necessarily hold true between production and prices. In some cases expanded acreage takes place by bringing under cultivation marginal land with a subsequent drop in yield per hectare.

and a lesser increase in production than expected. Such a sequence seems to have taken place in bean production, which, due to erratic government pricing policies, still seems to be adjusting after reaching a peak in 1975 following dramatic increases in price supports in 1973 and 1974.

c. Market Potentials and End-Uses.

It is apparent that Panama is reaching a level of self-sufficiency with respect to rice production. Panama exported a small amount of rice in 1978 and imported none or very little shortly before that year. At this moment corn is a deficit commodity within Panama and will undoubtedly remain in a deficit situation in the near future. Therefore, the potential for absorption of increased production is far greater than for rice due to the present ability to substitute imports. Edible beans are in the same situation as corn; the deficit position allows increased production for import substitution. Imports of corn and beans amount to approximately 20 and 35 percent respectively of total usage. In the case of rice it is incumbent on IMA to develop new end-use markets as well as to expand export markets.

2. Perishables

a. Current Marketing Structures

Perishables as a group, unlike grains, do not have a complex marketing system. The marketing channels for onions, tomatoes, and potatoes are narrow and lack the choices available for other commodities. The channels range from a very narrow monopsonistic situation in industrial tomatoes to a limited competitive market composed of trucker-merchant-wholesalers and IMA. Also in the case of potatoes a near monopoly exists in the form of the Junta de Comercialización de Papas. Another characteristic of this group of commodities is the lack of adequate storage, transportation, and handling which results in extremely high losses. Government intervention to expand storage facilities and improve storage and handling could significantly increase commodity supplies, and, at the same time benefit farmers by reducing market gluts.

b. Government Price Actions

Tomatoes are characterized by a farm-retail spread that has been narrowing over time. Without knowing farm support and fixed retail prices one could assume the cause to be unantici-

pated weak retail market. Some studies show extreme seasonal price variations throughout the year which is an indication of recurrent market gluts and low prices followed by an excess inventory of processed tomatoes. In general tomato products produced in Panama have not been competitive in world markets.

In contrast, potatoes show a steady margin between average farm and retail prices and with average farm price below farm support price. The reason for this behavior is unknown unless it is a result of a seasonal market glut situation to which current marketing channels are not able to adjust.

Finally, onions show a fairly stable farm-retail spread with average farm price substantially above farm support price. Apparently the competitive element between public and private sector has expanded the margin between farm price and farm support price.

c. Market Potentials and End-Uses

Increased market potential for perishables will depend on product differentiation, new end-uses, and demand creation since overall demand for fresh products is limited by population and per-capita income levels. These commodities are characterized by their seasonality and difficulty of long-term storage. Thus potatoes and onions must be supplemented with imports on a regular basis; approximately 20 and 45 percent respectively of total usage of these products is imported. A potential for substitution of imports exists assuming that off-season irrigation is made available for these crops. Such an approach must be well managed to avoid possible market saturation and a detrimental fall in prices.

Finally, end-uses for this group are currently limited mostly to fresh-consumption (except for industrial tomatoes). New potential end-uses such as dried onions, soups, snack items, and exports should be investigated through market research studies.

3. Livestock and Livestock Products

a. Current Marketing Structures

Beef and pork both have a simple and straight forward marketing channel. Except for some national and municipal slaughter-houses the industry is made up of private facilities. There appears to be an excess of physical facilities for slaughter, however, the magnitude of the problem cannot be accurately

ascertained. The impact of market structure on production by small producers is believed to be neutral.

b. Government Pricing Policy

Fixed ceiling prices for beef at the producer level increased from 36.5 ¢/kg. (on hoof) in 1970 to 54 ¢/kg in 1976 for a total nominal increase of 48 percent. Between 1976 and 1979 the farm price jumped an additional 55 percent to 83.5 ¢/kg. This price increase was ratified by an increase in the official ceiling price to 81.4 ¢/kg in May 1979. Prices of pork have also increased similarly over the past few years. However, at the retail level, average prices for beef do not show the same high increase as for pork. The degree to which ceiling prices are adjusted for inflation and the degree to which they are enforced or not enforced, will have in the future a significant impact on small farmer production.

c. Market Potentials and End-Uses.

Current consumption is approximately 3 kilograms per person (kg/cap.) of pork and 25 kilograms per person of beef annually. There is some importation of pork, suggesting a greater demand than domestic consumption data show .

Beef and pork are generally considered to be superior goods, the per-capita consumption of which increases as per-capita income increases. Since per-capita income has been increasing over time and is expected to increase in the future, the market potentials of these products should be an incentive to small farmer production.

4. Poultry and Eggs

a. Current Marketing Structure

This sector of the food industry is characterized by a vertically integrated structure and domination by a few firms. Except for some shortages in storage facilities this sector does not show any other constraints. However, the nature of the structure makes the entry by small farmers somewhat difficult unless they become part of the contract production arrangements currently in force. The other opportunity for small farmers to participate in the production of these commodities is to produce more for home consumption and for local markets.

b. Government Price Actions

The margin between average farm price and average retail price has narrowed considerably over time. This suggests some impact of government pricing and interventions. Under these conditions vertically integrated firms have a real market advantage making it difficult for small producers to enter the national market.

c. Market Potential and End-Uses.

While there appears to be a limited market where average consumption is approximately 7 kg/cap per year of poultry meat and approximately 5 kg/cap per year of eggs, the potential of this market cannot be accurately quantified. However, as was the case with beef and pork, poultry and eggs are superior goods and thus respond to increases in income.

5. Dairy and Dairy Products

a. Current Marketing Structure

Fluid milk and subproducts are handled by a few firms which receive their raw product from a few (45) large producers of Grade A milk and many medium and small producers. Although the market is oligopolistic in nature, the small producer apparently has an adequate local market. There are approximately 5,500 small producers of milk, and virtually all produce industrial grade milk. Imported milk products currently represent about 50 percent of total milk consumption.

b. Government Price Actions

In general, it can be observed that the margin (controlled) between average farm price and average retail price for milk remained fairly steady over time with a slight narrowing. The ceiling price of industrial grade milk has increased only 65% between 1970 and 1978; while Grade A has increased only 30 percent. In real terms the current prices for both grades and for retail fluid milk lag far behind the wholesale price index. This situation has caused processors to illegally blend industrial and Grade A milk sold at Grade A price, and has allowed them to protect operating margins. At the farmer level price controls have caused a decline in real income from milk sales.

D. Impact on Small Farmers.

Applied production research should not be implemented regard-

less of market conditions. First, it should be ascertained what commodities can or cannot be successfully marketed in increased quantities. Second, cost of production and cost changes influenced by applying adapted technology should be ascertained. Third, it is important to validate, through a sound data collection and analytic system, the actual impact of applied adaptive technology on the net income of the small farmer.

The following discussion by commodity group will refer to the potential impact of current market constraints and deficiencies as they affect attempts to increase small farmer production.

1. Grains and Edible Beans

The ability of Panama to handle increased production by small farmers can be greatly enhanced as IMA operates with greater efficiency and effectiveness as a marketing outlet for some of this production. IMA must be able to handle peak season output immediately following harvest by having sufficient storage to accept all commodities offered. IMA must also have the ability to pay quickly on terms which are satisfactory to the small farmer. If these market situations cannot be achieved, then the small farmer will lose a competitive outlet which helps keep prices of merchants or rice mills in line.

The impact of current support prices cannot be precisely determined. It appears that the relationship between past support prices and acreage increases indicates that small farmers respond to price incentives and hence may be willing to accept improved technology designed to increase per unit productivity. Economic benefit to small farmers depends upon the marginal cost of added production as well as the marginal benefits which are somewhat dependent on support prices. It is evident that great potential exists for greater productivity on small farms, and assuming marginal costs can be kept in line, marginal benefits could be substantial. Moreover, an increase in production at the small farm level would significantly benefit the total agricultural sector since it would reduce imports of edible beans, corn and milk products.

In summary, the marketing aspect which may have the most impact upon this commodity group is the ability of IMA to do its job with efficiency and effectiveness in reaching this group of farmers.

2. Perishables

This group of commodities is characterized by seasonal factors effecting supply; marketing constraints in the form of inadequate storage facilities and poor handling; technical limitations with respect to storage durability and a limited base for local end-use of products. The magnitude of small farmer participation in the production of these commodities cannot be accurately ascertained but their participation appears to be quite high. IMA participates in the purchasing, handling and distribution of perishables to different degrees ranging from 9 percent in potatoes, 50 percent in onions and less than 5 percent in tomatoes.

In order to increase production and production participation by small farmers,several key issues will have to be addressed. First, IMA will have to achieve greater marketing efficiency and effectiveness by being ready to support increased production at the given support price, able to adequately store these commodities in any amount sold to them, and to distribute the products. Second, IMA must address the seasonality factor which, together with the technical problem of long-term storage without loss in quality, contributes to market gluts, price fluctuations and waste. Unless these seasonal production cycles are smoothed out, perhaps by bringing off-season areas into production and/or by irrigation schemes, seasonal gluts and subsequent detrimental effects are liable to continue. Thirdly, and most important, new end-uses should be found for this group of commodities in the measure that production increases. This last requirement is a direct result of the limited market for fresh produce. In addition to new end-uses, markets must be developed for these products including exportation of processed products.

3. Livestock and Livestock Products

a. Poultry and Eggs

The increase in production by small farmers within this sector is going to be small, unless the farmer has a local market. The small producer has no national market unless he contracts with the vertically integrated industry. Also, given the present price structure in this commodity sector, certain economies of size must be achieved for the producer to obtain any significant net income benefits at the national market level. Thus, it seems that any participation by small farmers in this commodity sector would, at least initially, be limited to local markets.

b. Dairy and Dairy Products

For the small producer there is a local market to be served. Also, there is an apparent possibility of selling to processing plants which, in the year of maximum production, were still operating at 70 percent of capacity; however the excess capacity tends to be seasonal and production increases should be adjusted accordingly. Although the sanitation requirements and certain economies of scale will make it difficult for small farmers to competitively produce Grade A milk, a large market exists for the sale of industrial grade milk for processed dairy products. In the milk market, government pricing policy is the key variable constraining small farmer income.

c. Beef and Pork

Substantial gains could be made by small farmers participating in beef and pork production especially by producing these products in conjunction with other commodities. For example, pork production could be tied to yucca which provides an abundant and cheap starch source. Other types of feeding materials are also available to the small farmer thus allowing him to operate livestock production as a supplemental source of income. Although the precise impact of the current fixed price structure is unknown, there is strong evidence that the impact of pricing policies can be quite large for the small farmer and that if ceiling prices are frozen in nominal terms there will be little incentive for small farmers to move away from low level technologies. Also, the aggregate economic benefit of increased production by small farmers could be highly significant in adding value to the agricultural sector.

SUMMARY OF IDIAP's FIVE-YEAR PLAN

(Plan for the Generation and Transfer of Appropriate Technology)

The PLAN was prepared during almost a 12-month period (calendar year 1978) by IDIAP's top professional staff with assistance from consultants financed by USAID/Panama, from CATIE and the Rockefeller Foundation. It is currently being circulated within the Government of Panama for comment. The purpose of the Plan is to present IDIAP's long-range strategy of research, technology dissemination and utilization that will help achieve national development objectives. The technology generated and validated will be suitable to Panama's farm conditions, with particular emphasis on small and medium-sized farm applicability.

The consideration of the small and medium farmer's area-specific production constraints at an early stage in agricultural research programs had led to methodologies that place different demands on research management and institutions. The types of institutional adjustments required to provide the necessary capabilities especially at the local and regional levels are discussed in the Plan.

The Plan begins by describing the national and agricultural sector general policies and objectives, followed by available national human and natural resources plus a discussion of the present situation and outstanding problems. It then presents in detail institutional objectives, methodologies and strategies which are discussed in other sections of this Project Paper. The section on strategies includes implementation plans, research activities, plans for inter-institutional dissemination activities, and evaluation systems. Finally a summary of existing resources and facilities along with the requirements for implementing the Plan are presented.

After having established sectoral goals in Chapter I of the Plan, Chapter II is dedicated to a rather extensive review of the present situation in the agricultural sector. The review includes socio-economic indicators; bio-climatic aspects; actual and potential land use; land ownership and agrarian reform; organized farming groups, state farms and private farmer descriptions; breakdown of the various most important commodities; and inter-institutional cooperation, collaboration and division of responsibilities.

Chapter III discusses general and specific institutional objectives, which have been summarized in Section II.C.2. of the Project Paper.

Chapter IV goes into more details of the Five-Year Plan. It discusses strategies, including the reorientation of the Institute's

activities toward selected priority area programs instead of commodity or discipline-oriented programs. Particular emphasis is given to studying and helping solve directly the problems of the small farmers through research in the farmer's fields. The three regions of Chiriquí Province, Veraguas Province, and the Azuero Peninsula, after careful study were selected for concentration of the crops, animals, and integrated crops/animals production systems research and technology transfer activities. Research activities will begin in eight priority areas within the three regions.

The utilization of multi-disciplinary teams and other methodologies are discussed for the generation, validation, and dissemination of appropriate technology for the small and medium farmers.

A program of staff development and technical assistance requirements is presented in detail.

Finally in Chapters V and VI IDIAP's new organizational structure is discussed and the long range financing needs are discussed and presented in tabular form. All of this information has been utilized in the Project design process, and the Project will allow the Institute to implement its long-term Plan.

DETAILED DESCRIPTION OF IDIAP'S PRODUCTION SYSTEMS AREA-FOCUSED RESEARCH METHODOLOGY

I. INTRODUCTION

A key element in the success of this Project is introduction of a new (for Panama) small farmer production systems research methodology designed to generate and facilitate dissemination of technological innovations appropriate for Panama's small farmers and the conditions which confront them. This production systems methodology will be of three types: (1) cropping systems, (2) mixed dairy/beef production systems, and (3) mixed cropping/livestock systems. It will involve fourteen priority commodities. This Annex describes the general characteristics of the methodology, the types of production systems research and the priority commodities while specific applications are described in Section III.C. Project Activities.

II. THE SMALL FARMER PRODUCTION SYSTEMS METHODOLOGY

The new methodology employs a farming production systems approach. This methodology has been based on methodologies which are currently being employed by other Central American research institutes, particularly CATIE and ICTA with very promising results. The research methodology has been adopted after discussions with international consultants, travel to various country programs by the Director of IDIAP and several staff members and extensive study and analysis of Panama's specific conditions and requirements. IDIAP has also digested the results of several successful approaches including CIMMYT's Corn Production Program, ICTA's (Guatemala) technological systems for production, and CIAT's farming systems for small farmers.

The approach is almost identical to that employed by CATIE in its ROCAP financed Small Farms Production Project (596-0083), differing only at the dissemination stage. CATIE's assistance to IDIAP has been directly incorporated into the design for this project. CATIE's direct involvement with IDIAP through the ROCAP-CATIE project will greatly facilitate the adoption of the new methodology. The research methodology is also quite similar to the small farmer oriented research methodology successfully employed by ICTA for the past seven years.

The research methodology will focus on the development of technologies which are economically as well as technologically feasible at the micro (on-farm level. A key element of the methodology is that farmers will be directly involved in most aspects of the research process. The research will primarily be conducted on small farms in the actual environment in which the farmers operate.

The traditional research focus of controlled field trials on state owned research plots to determine suitability of new crop varieties, etc., will not be entirely abandoned (although its importance will be diminished). Rather, its results will serve as a logical complement to the on-farm program.

The production systems approach flows from a recognition that the farmer or rancher must manage a complex agroecosystem in which a number of disparate factors interact to affect production levels and that the agricultural technology which the farmer employs is only one of these factors. To verify that proposed technological innovations are in fact both technically and economically feasible they must be tested within the actual agroecological system to determine how an innovative practice affects and is affected by other systemic factors. In particular where crop rotations or crop and/or crop/animal associations exist, a change in a cultural practice for one crop may have significant (positive or negative) impacts on the production of other crops or animals.

Also, it is this interdependence of agricultural technology with other factors which makes area specific research (in order to obtain relative homogeneity of physical factors) and scale specific research (because farm size is generally correlated positively to degree of access to productive inputs) more attractive.

In order to implement the new research methodology a multidisciplinary approach involving not only plant, animal and soil scientists but also other specialties such as agricultural economics, rural sociology and communications is required. Furthermore, because climate, soil characteristics, and cultural characteristics as well as many other factors are heterogeneous, even in a country as small as Panama and an area focus is required so that research results can be validated and successfully disseminated within a relatively homogenous setting, a number of research teams are required.

A. Area Selection

The first step in the research process is area selection. This has already been accomplished for the initial phase of IDIAP's research program and eight priority geographic areas have been selected. These project areas were chosen after careful analysis of the Ministry of Planning's summary of agricultural sector priorities to determine those districts where large percentages of established priority commodities were produced. Consideration was also given to those areas with:

1. A high concentration of small, marginal/subsistence farm families both in single and mixed crop farming, and dual-purpose livestock production;

2. Organized farming organizations (to facilitate more efficient and rapid technology transfer);

3. Considerable homogeneity as regards farm sizes, farming practices, soil types, ecological conditions, social structure, and other factors;

4. Existing or planned feeder roads which make large acreages of good farmlands accessible to markets and supply lines;

5. Other development programs underway or planned such as integrated rural development projects, agrarian reform, credit, and agro-industries;

6. Good or reasonable potential, for increased agricultural productivity in some of the priority commodities, with resultant increased net farm family incomes.

B. Diagnostic Studies

The second step of the research activity is that of carrying out diagnostic studies. This will involve extensive surveying and collection of other data on the characteristics of the selected areas and of on-farm conditions in those areas. These diagnostic studies will be carried out by special teams which will include members of the area research team (see below) as well as a number of personnel specialized in areas such as economics, rural sociology, and sample surveying. The diagnostic studies will be carried out with the objective of identifying the physical, technical, economic and social conditions in which the applied research activities are to take place. Information sought will include size of farming units, prevailing farming systems and cropping patterns, biological and ecological factors, land ownership, availability and utilization of agricultural credit and/or of commercially available products on inputs, investment, types of organized farming groups, management practices, motivation, and market channels. Particular attention will be paid to the economic aspects of farming at the level of small farmer. Assistance from CATIE, ICTA and CIMMYT is being provided in the development of questionnaires and in the training of the diagnostic study teams. Diagnostic studies have been begun in four priority areas (Caisán, Los Santos, Sur de Soná and Gualáca) with participation by and technical advice from CATIE personnel. In addition, the IDIAP and cooperating Panamanian personnel which form the diagnostic study teams will be located within each of the target areas for several weeks during the execution of the studies. By spending several weeks in the target areas, IDIAP technicians will be better able to discuss farming problems with the target group farmers and to gain their confidence.

The diagnostic studies will serve as a major source of information to facilitate initiation of the next step in the research process, analysis of constraints. In addition, they will provide the baseline data for subsequent project evaluations.

C. Constraints Analysis and Development of Research Plan

In each area personnel will carry out an analysis of constraints. The data generated in the diagnostic studies as well as information obtained from the informal contacts with areas in which technological constraints amenable to applied research activities inhibit productivity. This analysis will identify research problems based on the real world situation of the Panamanian small farmer rather on a prior conception of farmers problems which may be held by the research scientists. The research topics identified by the team will be "validated" through discussions with the small farmers in each target area as well as by MIDA production agents and BDA area representatives. They will be incorporated into an overall research plan for each area. Because of limited resources only two or three research topics with the highest priority in the research will be incorporated into the research program in an area at any one time. These research priorities will be reviewed on an annual basis and the research plan will be maintained and/or adjusted as new technologies are validated.

D. Technology Development

The fourth step in the research process is the generation of appropriate technologies, i.e., the actual research process. This research will be conducted by multi-disciplinary research teams in crop systems, mixed beef/dairy and mixed crop/livestock systems. The composition of these teams will be (as needed) (1) cropping systems -- agronomist, plant breeder, soil fertility/productivity specialist, entomologist, plant pathologist, economist -- farm management specialist, sociologist, soil and water management specialist, and weed specialist; (2) animal production -- animal nutritionist, animal production specialist, swine production specialist, tropical pastures expert, economist, sociologist, animal health specialist, milk production specialist, livestock improvement specialist, and soil fertility specialist; (3) combined crops/livestock -- animal/crop production systems specialists, soil and water management specialist, integrated pest management specialist, horticulturist, livestock system improvement specialist, economist, animal nutritionist and sociologist. Not every specialty will be required in every area and some specialists may work only part time in a specific geographic area or in a specific geographic area on an as needed basis.

The general research philosophy is to build on or modify the production systems currently employed by the small farmers or ranchers

rather than to attempt to introduce completely new systems. Therefore, the major portion (70-80%) of this research effort will be conducted on farms selected from the universe of small farmers in each geographic area with, of course, the agreement of the farmers who will be actively involved in the research process. Farms selected will be strategically located within the project area to maximize demonstration effects for surrounding farmers. While small farms will be representative of area farms, attempts will be made to select innovators who have positive attitudes toward experimentation and who serve as sources of the diffusion of technology within their areas. Also asentamientos and other groups will be utilized when feasible in order to maximize the use of already existing information networks. At the same time complementary research will be carried out on IDIAP's experimental plots located within the geographic area and in laboratories when appropriate.

The rationale for both on-farm research and experimental plot research is that while on-farm research allows for experimentation within a real production system there are still certain research activities, e.g., field testing of new seed varieties and/or other recommended practices which should be done on experimental plots before on-farm testing occurs.

The number of farms on which research will be conducted will vary according to the types of the research priorities identified. Generally, at least two or three farm units per area will be involved at this stage. In some activities as many as 10-15 farmers will participate. In no case will research-related activities constitute a large enough activity on any individual farm to generate a high degree of risk for the participating farmers. Research during this phase will occur under highly controlled conditions and with very close supervision of the experiments by technical personnel.

Although specific research problems are to be identified in each geographic area, general research categories include crop associations and crop rotations with specific types of sub-projects such as genetic improvement, soil fertility and productivity plant protection, and crop management.

Research at this stage, will not only adapt technologies generated in IDIAP's crop and animal research but will also test technologies already generated through the activities of other world and regional agricultural research centers such as CATIE, CIAT, CIP, CIMMYT, and ICTA. CATIE, through the ROCAP backstopped Small Farm Production Systems Project being carried out with IDIAP, will be a major source of technical assistance in this regard. Also, IICA/ROCAP's PIADIC Project is expected to provide a number of area specific testable technology packages to IDIAP. Maximum utilization

of these technologies available from centers will reduce costs, in terms of time, money and human resources, required to develop technologies appropriate for each specific area.

This phase of the project will be on-going process. As new practices or other technologies, each of which may take several years to test, especially in animal related research, are validated, new research topics will replace them.

E. Validation

Once a technology has been sufficiently developed and tested on the research farms, it must then be subjected to a process of validation. At this stage a practice or practices are tested on a larger number of farmers -- 20 to 30 -- in each area. The validation process requires two years (in the case of crops) or more in the case of animal-related activities. During the first year the practice is introduced under close supervision and participating farmers are continually provided technical assistance. During the second year activities of the participating farmers are closely monitored to determine to what extent the practice has actually been adopted.

Farmers at this stage will be selected from volunteers who have become interested in the research activity through direct contacts as a result of outreach activities by research personnel, field days, or simply from passing by the research fields. Experience of IDIAP research scientists in the Cerro Punta area, for example, where contact has been made with more than 200 farm families, has shown that a large percentage of them are quite interested in participating in on-farm trials.

At this stage special attention will be paid to studying economic benefits, and in assessing comparative efficiency in land and labor utilization. Availability of complementary production inputs (seeds, fertilizer or pesticides) or credit which may be required on terms accessible to the small farmer will be verified. Because simple management practices that are modifications of traditional farming methods insofar as possible, will be emphasized, especially in the early years following the introduction of area-oriented research, and sophisticated technological packages will be avoided, the need for complementary inputs will be reduced.

Participating farmers will be fully informed as to the rationale for the introduction of the new or modified practice or practices. As in the research stage participating farmers will also continue with their traditional practices on the major portion of their plot. They will thus be able to directly assess the advantages of the new practices.

F. Dissemination

The final step in the applied research activity is the dissemination of the validated technologies. This dissemination will be achieved through the integration of technicians who serve in extension capacities into the research process. In each geographic area MIDA will assign two production agents to work with the research team on a full time basis. In addition, other professionals from different MIDA directorates, particularly from the Directorate of Agricultural and Livestock Production and in the Directorate of Social Development, as well as from the BDA will participate on the research teams in each geographic area as may be needed. The production agents and the personnel on rotational assignments will all be involved in the research process particularly at the validation stage and will, therefore, be completely familiar with the new practices to be disseminated. Furthermore, within the project areas, both the research scientists and the extension personnel will actively promote the dissemination of new or modified technologies. All members of the research teams will make contacts with target group farmers primarily through direct farm visits and field days on farms where the validation process is occurring. A direct linkage will, thus, exist between the generation of appropriate agricultural technologies and their dissemination in the target areas. The incorporation of personnel from MIDA will facilitate a wider dissemination of research results when these individuals are reassigned elsewhere or resume their former duties. Also, the large number of validation farms will serve to promote the technological modifications through informal communication channels. The existence of organized groups, asentamientos, juntas agrarias, and cooperatives will facilitate dissemination through more formal channels. These groups will be used as extensively as possible, viz. IDIAP's work with the potato producers' cooperative in the Cerro Punta area of the Bugaba District.

In addition to the direct contracts made by IDIAP technicians and production agents, mass media techniques, especially radio of the distribution of simple leaflets will be used. A significant effort will be made to strengthen MIDA/IDIAP capabilities to produce and disseminate mass media materials.

III. TYPES OF PRODUCTION SYSTEMS RESEARCH

Research in small farmer production systems may be divided into three categories: cropping systems, mixed beef/dairy production systems and mixed crop livestock systems.

The cropping systems research will emphasize efficient management of production resources (including soil, water and capital goods) for existing crops combined with plant adaptation research and pest control where appropriate. This research will also focus on different types of crop associations and new crop rotations to raise on-farm net income. Specific types of interventions might include:

- modification in planting techniques
- planting dates,
- crop density and pest control methods,
- improved seed,
- new crops,
- utilization of small machinery,
- utilization of organic fertilizers,
- improved water management,
- soil conservation,
- new harvesting methods,
- better on-farm storage

The plan for implementation of cropping production systems research is:

1. Selection of priority commodities.

2. Selection of geographic areas of concentration.

3. Diagnostic studies of each selected area.

4. Formation of a multi-disciplinary team.

5. Identification of major problems and/or production constraints. Since all problems can not be solved initially, priority problems will be defined from which highly visible solutions can be developed. Direct solutions from known principles and experiences will be sought first and adapted to specific farmer problems and resources.

6. Evaluative research methods (validation) will be used under farmer conditions for the assessment of solutions. Results will be used to redefine problems and improve their solutions.

   Applied research at the experiment station (in controlled plots, greenhouses, and laboratories) will be carried out only for evaluating complex alternative solutions to high priority problems which require more careful study (severe insect, disease or nematode problems; sophisticated selection or development of genetic material, etc.).

7. Various alternative channels for dissemination will be developed with collaborating institutions, organizations, and farm groups. Techniques for technology transfer will include direct farm visits, additional area projects, demonstrations, field days, production training courses, radio, etc. Personnel from MIDA's Crop Production and Social Development Directorates and from the Agricultural Development Bank will participate.

Although this area-specific cropping system approach is still a somewhat new concept for IDIAP, some notable progress has been made in two of the priority areas. Annex III, Exhibit D contains descriptions of the on-going cropping systems research in the Renacimiento and Bugaba Districts of Chiriquí Province.

The mixed beef/dairy production systems research is designed principally to solve the production constraints of the small and medium beef/milk producers who produce 60% of the nation's milk and substantial part of the beef supply. Research has been conducted in this area by IDIAP for a number of years with CATIE assistance and it concentrates on four general areas: animal management, animal genetics, feeding and animal sanitation. Specific technological modifications might include

- improved pastures,
- pasture rotation,
- controlled breeding,
- herd management,
- supplemental feeding, and
- improved milking arrangements.

The plan for implementing the beef/dairy production systems research consists of the following steps:

1. Formalizing inter-institutional working agreements.

2. Selection of three priority geographic areas.

3. Area and farm diagnostic studies.

4. Formation of multi-disciplinary team.

5. Selection of a particular rancher with representative conditions, and contracting for setting up a 20-30 hectare modular unit in each of the three priority areas.

6. Analysis of production constraints.

7. Implementing research to generate various possibilities of improved farm management. (Some of these will be eliminated through evaluation research on the modular units and on collaborating farms.)

8. Design, test, evaluate, and recommend, along with pertinent training of production agents and ranch personnel, appropriate production management packages or farming systems including mixed farming, soil conservation practices, etc.

9. With collaborating institutions (such as MIDA's Animal Production Directorate, the Agricultural Development Bank, the

Livestock Program of the National Bank of Panama, cooperatives, private organizations and farm groups), develop channels and strategies for expanding the radius of technology transfer to similar producers.

Step 1 through 5 have been completed for three geographic areas of concentration which were selected to conform to the three most important milk producing areas in Panama by dual-purpose cows. The areas (Gualaca, Montijo and Los Santos) are in the Provinces of Chiriquí and Veraguas and in the Azuero Peninsula which, together, produce 80% of the nation's milk and a high percentage of the beef. Information on this activity is contained in Annex III, Exhibit D.

Mixed cropping/livestock systems research/technology transfer activities will not be undertaken initially in any priority area. However, in most areas a substantial percentage of small farmers/ranchers do engage in both livestock production and cropping activities and IDIAP's multi-disciplinary research teams will begin this type of research activity in selected priority areas once the cropping and animal production system research activities are well established. The mixed cropping/livestock activity will focus on better use of vegetative matter, improved allocation of resources between crops and livestock, and the introduction of small animal production. It is expected that, the research staff will have to have acquire a relatively high level of expertise in order to deal with the larger number of system variables which will be presented.

IV. PRIORITY COMMODITIES

In each geographic area several (at least two or three) commodities will be targeted as priorities for initial research activities. These commodities represent the major products produced by small farmers in the area. They are identified for each area in Section III.C.1.a. of the text.

The priority commodities selected for this project also correspond with the top priority commodities of Panama's present Five-Year Plan and the more current Three-Year Plan (1978-1981). Out of the National Plan's list of most important commodities, only sugar cane and bananas are not included in at least one of the eight area-specific programs. Priority crops include rice, corn, sorghum, tomatoes, potatoes, onions, soybeans, edible legumes (including kidney beans and cow-peas) and yuca. In areas where additional crops such as yams, other vegetables, coffee, and fruit crops potentially economically viable, they will be incorporated in the adaptive research and technology programs wherever feasible. Although such products are not "priority" commodities they will be regarded as "targets of opportunity" any time they can economically be produced by small farmers and marketed either through export or agro-industries.

Priority livestock commodities, include beef, pork, milk, poultry and eggs. As funds permit, and depending upon producer interest, some attention may also be given to other small-animal production such as ducks and rabbits.

The major justification for the selection of these 14 top priority commodities is that they comprise the basic food crops of both the rural and urban sectors. Also, they are (with the exception of soybeans) the major commodities produced and consumed by small farmers.

PROJECT AREA DESCRIPTION

Seven of the eight priority project areas are located in the provinces of Chiriqui and Veraguas, which have been identified as the two most important agricultural regions with the highest concentration of small, marginal farmers and organized farming groups. The remaining priority area, located in the Province of Los Santos, is another important agricultural region which like the other two has good potential for increased agricultural production through research and dissemination of technology.

Initial efforts will be focused on small farmers in the following eight areas (see Map of Initial Priority Areas): 1) Plaza de Caisan, Renacimiento District, Chiriqui Province; 2) Northern Sections of the Baru District in the Chiriqui Province; 3) Cerro Punta in the Bugaba District of the Province of Chiriqui; 4) Gualaca District of the Province of Chiriqui; 5) Sur de Soná in the Soná District of the Veraguas Province; 6) Santiago/La Mesa/Cañazas area is made up of parts of the Cañazas, La Mesa, Santiago, and San Francisco Districts in the Province of Veraguas; 7) The Montijo area in the Montijo District of Veraguas Province; 8) Los Santos area is located in the Los Santos District of the Province of Los Santos. Activities in the Renacimiento, Baru, Bugaba, Gualaca, Soná and Montijo districts will be expanded to reach the entire district during the life of the project.

Information on agricultural activities and infrastructure as well as physical factors is presented for each of the eight priority areas.

I. BUGABA

A. Location: Bugaba District, Chiriqui Province, Western Panama bordering on the district of Renacimiento in the West and the Province of Bocas del Toro in the North. (see map).

B. Target Population: 39,466 on 5,550 farms.

C. Topography: Elevation 700-3474 meters. Very mountainous and steeply sloping (the Barú volcano 3474 meters is the highest point in Panama). Valley floor is undulating but farming has moved up onto very steep mountain slopes.

D. Soils: (1) Type - Volcanic origin, range from moderately

deep to deep, arable, loam soils, good internal drainage, fertile. Total land area = 85,540 hectares.*

(2) Potential Use - 6,160 hectares of I-A land with the capacity to support or sustain intensive production of high yielding annual crops such as vegetables as well as permanent crops with high economic returns such as coffee. Conservation needed even on these gentle slopes. 704 hectares of I-P land suitable for intensive production of permanent crops such as fruits and coffee. (see Table). These permanent crops serve the necessary function of conserving soil and water in these fragile areas; much more conservation is urgently needed.

(3) Total land in farms - 73,692 hectares.*

E. Climate: (1) Precipitation

a. 2500 - 3000 mm/year, much of it as hard showers.

b. 10 months high rainfall February-November; 2 months low rainfall December-January.

c. 2 "dry" months from 20-46 mm/month.

(2) Temperature-cool, averaging 18°C ± 5°C. The drier months and warmer seasons coincide with cold seasons in northern hemisphere.

F. Agricultural Activities:

(1) Present - Highly intensive farming of potatoes, onions, cabbage, lettuce, carrots, broccoli, celery, beets and radishes presently takes place in Cerro Punta even on very steep slopes where severe erosion problems exist. Dairy cattle at lower elevations.

* 1971 Agricultural Census.

(2) Future - With Research/Dissemination some triple cropping of vegetables would be possible as well as development and introduction of improved varieties. Introduction and establishment of oranges, blackberries and strawberries as an important economic crops is also possible. Practical conservation practices need to be introduced, and enforced, to guarantee water for downstream uses (hydroelectric, irrigation, and domestic.)

G. Land Tenure:

(1)	Titled land occupied by owner	642 farms=21,805 has.
(2)	Rented land	233 farms= 4,042 has.
(3)	Land occupied without title	3,900 farms=26,832 has.
(4)	Mixed occupation	750 farms=21,013 has.

(See land tenure table).

H. General Agricultural Infrastructure:

1. Roads: Approximately 10 Km asphalt, 35 Km gravel. AID financed rural access roads under consideration for this area. 1-A lands would be opened up by construction of these roads.

2. Markets: Cerro Punta is an IMA buying center for potatoes and onions through cooperatives established there. Potato cooperative has sophisticated sorting and storage facility in Cerro Punta. Independent trucker buy from 50-80% of products in area directly from farmers and move them to David or Panama.

3. Credit: Total credit extended by BDA in 1978 for selected commodities $1,642,000 (see credit table).

4. Agricultural Organizations: 5 cooperatives = 480 families.

5. Schools: Small school wants to convert to Ciclo Básico.

6. **Agricultural Research:** Branch Research station of IDIAP located in Cerro Punta. Research being carried out on potato disease, varieties, quality, fertilizer, etc.

II. RENACIMIENTO

A. **Location:** Renacimiento District, Chiriqui province, Western Boundary of Panama with Costa Rica. (See Map).

B. **Target Population:** 8,049 on 1,351 farms.

C. **Topography:** Elevation of 400 - 1370 meters, very mountainous with some flat to undulating table lands.

D. **Soils:** (1) Type - Volcanic, moderately deep to deep, arable, loam soils, friable, good drainage. Fertile. Alluvial soils on smoother lands. Total land area = 57,960 ha. (1971 Agricultural Census).

(2) Potential Use - 23,277 hectares of I-P land suitable for intensive permanent crops such as coffee, fruits and considerable annual crops using conservation, especially on the hardpan soils of Caizan. 13,678 hectares of II-P land suitable for improved pasture.

(3) Total land in farms - 41,038 ha.(1971 Agricultural Census).

E. **Climate:** (1) Precipitation

a) 2,500 mm - 3,500/yr. lower areas drier than higher.
b) 9 months high rainful - 3 months low rainfall (see table).
c) 3 "dry" months between December-February with only 15-45 mm/month.

F. **Crops:** (1) Present land-use - Traditional farming-few modern inputs. Beans, corn, coffee, tobacco, pastures for dairy some pineapple,

I-P, pasture on II-P.

(2) Future use - increase in production of all these crops with opening of access roads and Research/Technical Assistance, 5900 hectares of coffee (new and better varieties), more tobacco and beans, large potential beef and milk production. Conservation needed as well as other modern production practices in order to increase yields on these volcanic soils, and maintain them.

G. Land Tenure:

(1)	Titled land occupied by owner	40 farms=	2,582 has.
(2)	Rented Land	17 farms=	103 has.
(3)	Land occupied without title	1156 farms=	30,451 has.
(4)	Mixed occupation	138 farms=	7,902 has.

H. General Agricultural Infrastructure:

1. Roads: Approximately 15 Km asphalt, 50 Km gravel existing. 95 + Km of all weather rural access roads now under construction, with Caisan as hub. Financed by AID project which will open I-P and II-P land for production.

2. Markets: Principle markets for corn, beans, coffee are IMA's purchasing and buying centers in Cerro Punta, Volcan, Concepción, and David. San Andreas tobacco sold in Concepción and David.

3. Credit: Total credit extended by FDA to groups and individuals in 1979 for crops and livestock was $351,000 (See Table).

4. Agricultural Organizations: 6 Juntas Comunales with 180 families.

5. Schools: Ciclo Básicos in Plaza de Caisán, San Andreas and Renacimiento. Emphasis in education on agriculture and livestock.

6. Agricultural Research: IDIAP carrying out poroto bean (red kidney) experiments in Caisan in 1979.

F. Agricultural Activities:

1. Present - Bananas (UFC has. 5,000 has.) and Plantains account for 79% of crop production in the Baru District. Over 7,000 has. of bananas are grown in this area. Corn, beans and rice are grown in the traditional manner, as well as by farmers belonging to "asentamientos" (colonies) using modern inputs. There is also some pasture for dairy and beef production.

2. Future - there is a plan to set up a 3,000 ha. African oil palm plantation and construct an oil processing plant. A world bank multimillion dollar loan for this operation has already been signed. (AID Funds will not be involved in African oil palm activities).

   As farmers learn to manage modern inputs through research/dissemination and experience more land can be brought under intensive annual cropping through the effective use of irrigation and drainage; enough surface water is available to double the current 7,000 has. of irrigation.

G. Land Tenure:

1.	Titled land occupied by owner	108 farms =	2,692 has.
2.	Rented land	108 farms =	2,803 has.
3.	Land occupied without title	2,579 farms =	26,851 has.
4.	Mixed occupation	171 farms =	29,534 has.

H. General Agricultural Infrastructure:

1. Roads: Approximately 20 Km asphalt - 75 Km gravel. A railroad exists connecting Puerto Armuelles with La Concepción.

2. Markets: Bananas are exported from Puerto Armuelles. Corn, rice and beans are sold in Puerto Armuelles, David and Panama.

3. Credit: Total credit extended by BDA to groups and individuals in 1978 for crop and livestock was $1,358,000.

4. Agricultural Organizations: 15 asentamientos with 500 families.

5. Schools: Two Ciclos Básicos - Progreso and Finca

III. BARU

A. Location: Baru District, Chiriqui Province, western Panama borders Costa Rica and has a good deal of Pacific Ocean coastline. (See map)

B. Target Population: 40,367 on 2,966 farms.

C. Topography: Range of elevation 0-700 meters. Mountainous, rolling hills and fairly extensive alluvial plains.

D. Soils:

(1) Upland-type soils are old, residual, weathered soils with low fertility. Watershed conservation necessary for prevention of winter flooding and to insure a summer water supply to low land areas. Alluvial soils of volcanic origin are deep and fertile although some are quite heavy (clay). Total land area = 66,403 ha. (1971 Agricultural Census).

(2) Potential Use - there are 20,912 has. of I-A lands which are suitable for intensive annual crops or highly profitable crops such as bananas. There is another 6,051 has. of I-P land which has the capacity to support intensive perennial crops such as bananas or other fruits. There is also 18,685 has. of II-P lands suitable of extensive pastures with improved management.

(3) Total land in farms - 61,880 ha.

E. Climate:

(1) Precipitation

a. 2293-3500 mm/year
b. Poor distribution - very heavy rainfall in 6 or 7 months.
c. 5-6 month "dry" season - Irrigation during summer months necessary for intensive cropping of bananas, etc.

(2) Temperature Average minimum - average maximum 17-32°C. Yearly average 25°C.

Blanco with Agricultural orientation.

6. Agricultural Research: IDIAP is carrying out research on corn varieties and fertilizer, sorghum varieties and fertilizer, rice fertilizer, disease control.

In general, the infrastructure is "in place" although some special aspects need improving marketing facilities and channels for crops other than bananas, schools and health facilities, housing and improved water supply for those not living on banana plantations.

IV. GUALACA

A. Location: Gualaca District of the Province of Chiriqui, northeast of the City of David.

B. Target Population: 6,482 on 1,002 farms.

C. Topography: Range of elevation 50-2200 meters. Predominantly mountainous with some rolling hills and very little flat land.

D. Soils: (1) Type - Mostly upland, old, residual, highly weathered soils with low fertility and limited potential use. Very limited areas of alluvial soils of high fertility. Total land area = 60,482 has. (1971 Census of Agriculture)

(2) Potential Use - only 850 hectares of I-A lands and 100 hectares of II-A lands which may be used for intensive and extensive annual cropping (respectively) with good management and conservation. 2200 hectares of II-P lands which can be planted to extensive improved pasture with tood management.

(3) Total Land in Farms - 42,583 hectares. (1971 Census of Agriculture).

E. Climate: (1) Precipitation

a. 2300-4900 mm/yr.
b. Poor distribution of rainfall-moderate

to heavy 7 months.

c. Dry season for 4 or 5 months December-April.

(2) Temperature - warm, varying between 19-32°C average temperature is over 24°C. Tropical Humid Climate.

F. Agricultural Activities:

(1) Present - Mostly traditional crops. Kidney beans, main area of production is in beef and dairy cattle. (An average of 72 head/Farm) (1971 Census of Agriculture). Faragua is the major pasture grass, Indiana grass being almost as important. Winter milk production for entire Chiriqui Province is 4.10 liters/day/cow. (Carta Informativa Pecuaria, IDIAP. April 1979, no 6. p. 11).

(2) Future - small areas of animal crops. Silage and improved pasture can be combined with good management to produce more leaf and milk.

G. Land Tenure:

1.	Titled land occupied by owner	51 farms = 4,340 has.
2.	Rented land	60 farms = 5,096 has.
3.	Land occupied without title	763 farms =19,726 has.
4.	Mixed occupation	128 farms =13,421 has.

H. General Agricultural Infrastructure:

1. Roads: Approximately 15 Km paved, 60 Km. dry season roads.
2. Markets: Gualaca, David, and Panama for traditional crops. Both Nestle and Borden purchase milk along the main roads in the dry season.
3. Credit: Total credit extended by BDA in 1978 for crops and livestock was $239,000.
4. Agricultural Organizations: None
5. Schools: Ciclo Básico of Gualaca with livestock orientation.
6. Agricultural Research: IDIAP has a Branch Research station in Gualaca which is the center for

livestock research. A research project in conjunction with Canada for improvement of dual purpose (milk/beef) cattle production, is under way at this station. CATIE/ROCAP provides a livestock expert headquartered in Gualaca. AID financed activities in this area will focus on cattle.

V. SANTIAGO/LA MESA/CAÑAZAS

A. Location: This area is comprised parts of all of six corregimientos in four different Districts of Veraguas Province; San Marcelo, Cañazas District, Cabecera and Bisvalles, La Mesa District, Remance, San Francisco District, La Peña and San Pedro, Santiago District (See Map).

B. Target Population: 16,014 on 3,061 farms.

C. Topography: Range of elevation 40-500 meters. Low rolling hills and plains.

D. Soils: (1) Type - Predominantly old, leached residual, soils with low fertility. Some heavy alluvial soils with drainage problems. Total land area = 71,010 ha. (1971 Census of Agriculture).

(2) Potential use - Approximately 500 hectares of II-A land in the alluvial flats suitable for rice, grasses or forage. More than 20,000 hectares of II-P land in low rolling hills suitable for improved pasture.

(3) Total land in farms = 29,514. (1971 Census of Agriculture).

E. Climate: (1) Precipitation

a. 2,300 - 3,500 mm/yr.
b. Poor distribution during 8-9 months rainy season.
c. 3-4 dry months.

(2) Temperature average daily minimum and maximum 20.6-33.1°C, daily average 26.8°C.

F. Agricultural Activities:

(1) Present - Cattle and traditional crops of rice, beans and corn. Average of 20 head of cattle/farm. (1971 Census of Agriculture). In Veraguas Province the average winter milk production is 3.8 liters/cow/day. Faragua grass accounts for 94% of the pasture. (Carta Informativa Pecuaria. IDIAP. April, 1979 no.6, pp. 10, 11.)

(2) Future - Improved pasture and forage crops for dry season supplement making livestock industry more productive.

G. Land Tenure:

SANTIAGO

1.	Titled land	531 Farms	= 20,141 has.
2.	Rented land	283 Farms	= 1,623 has.
3.	Land without title	2,542 Farms	= 30,085 has.
4.	Mixed occupation	652 Farms	= 16,315 has.

LA MESA

1.	Titled land	153 Farms	= 10,250 has.
2.	Rented land	119 Farms	= 239 has.
3.	Land without title	1,153 Farms	= 11,370 has.
4.	Mixed occupation	201 Farms	= 5,126 has.

CAÑAZAS

1.	Titled land	87 farms	= 1,833 has.
2.	Rented land	38 Farms	= 266 has.
3.	Land without title	1,911 Farms	= 16,402 has.
4.	Mixed occupation	126 Farms	= 5,286 has.

SAN FRANCISCO

1.	Titled land	124 Farms	= 4,692 has.
2.	Rented land	52 Farms	= 120 has.
3.	Land without title	1,140 Farms	= 11,750 has.
4.	Mixed occupation	139 Farms	= 3,762 has.

H. General Agricultural Infrastructure:

1. Roads: Approximately 110 Km paved, 200 Km dry weather.
2. Market: Santiago is Panama's 3rd largest national

market.

3. Credit: Total credit extended by the BDA in 1978 for selected commodities was $1,271,000.
4. Agricultural Organizations: A total of 5 asentamientos and cooperatives with 150 families.
5. Schools: Ciclos Básicos at La Mesa, Cañazas, and Santiago (Escuela Normal) National Vocational Agriculture School located in Divisa.
6. Agricultural Research: Ministry of Agriculture and IDIAP Headquarters located in Santiago. Land available at Calabacitos for research.
7. Related Activities: URBE. Santiago Regional Service Center.

VI. SONA

A. Location: Soná District, Veraguas Province on the Gulf of Montijo. (See Map).

B. Target Population: 19,372 on 3117 farms.

C. Topography: Range of elevation: 0-545 meters. Mostly rolling hills with slopes up to 45%. Large areas of plains.

D. Soils: (1) Type - Predominantly old, residual, weathered latosols, highly acid and low in fertility. Approximately 8,000 hectares of alluvial clay soils. Total land area = 148,800 ha. (1971 Agricultural Census)

(2) Potential use - Approximately 31,186 hectares of I-P land which can be used intensively for perennial crops with water control. Almost 4,500 hectares of II-A land with some drainage problems suitable for forage crops or improved pasture with careful management of water. More than 20,000 hectares of II-P land suitable for pasture.

(3) Total land in farms - 93,470 ha. (1971 Agricultural Census).

E. Climate: (1) Precipitation

a. 2,700 - 3,600 mm/yr.

b. Poor distribution 8 very rain months and relatively dry or very dry months.
c. 3-4 severely dry months.

(2) Temperature - warm varies between 19-29°C with an annual average of 25°C.

F. Agricultural Activities:

(1) Present - Principally rice and traditional crops.

(2) Future - with good management, and water control approximately 3,000 hectares of fruits or other perennial crops can be grown on I-P land. 4,500 hectares of rice, forage or improved pasture and 20,000 hectares of extensive pasture are possible.

G. Land Tenure:

(1) Totals for entire Sona District.

1.	Titled land occupied by owner	332farms =	26,014 has.
2.	Rented land	225 farms=	1,781 has.
3.	Land occupied without title	2,255 farms=	46,216 has.
4.	Mixed occupation	305 farms=	23,620 has.

H. General Agricultural Infrastructure:

1. Roads: Approximately 40 Km paved, 100 Km dry weather roads.
2. Credit: Total credit extended by BDA to groups and individuals in 1978 for crops and livestock was $1,789.000.
3. Agricultural Organizations: There are 28 asentamientos with 840 families.
4. Schools: Ciclos Básicos - Cative and El Tigre de San Lorenzo.
5. Agricultural Research: IDIAP is doing research on Sorghum-planting season and pests; rice-dryland yields, fertilizer and pest control.

VII. MONTIJO

A. Location: Montijo District, Veraguas Province on the west coast of the Azuero Península (See map).

B. **Target Population:** 9,414 on 2,813 farms.

C. **Topography:** Range of elevation 0-1269 meters. Rolling hills and plains predominate the northern part with some very mountainous areas in the southern central part of the península.

D. **Soils:** (1) Type - Mostly old, residual, highly leached latosols with low fertility. Some heavy alluvial clay soils with moderate to high fertility. Some heavy alluvial clay soils with moderate to high fertility. Total land area = 209,100 ha. (1971 Agricultural Census).

(2) Potential use - More than 6,000 hectares of I-P soils suitable for intensive perennial cropping under proper management; approximately 8,000 hectares of II-A soils with drainage problems can be used for extensive cropping or forage. Almost 30,000 hectares of II-P land is suitable for pasture.

(3) Total land in farms - 100,429 ha. (1971 Agricultural Census).

E. **Climate:** (1) Precipitation

a. 2,400 - 3,500 mm/year.
b. Uneven distribution during 8 wet months.
c. Severe dry season January - April

(2) Temperature - warm to hot, average 26°C.

F. Agricultural Activities:

(1) Present - Rice, beans and corn are grown traditionally by many small farmers; farmers belonging to asentamientos use modern inputs to produce these traditional crops but with inadequate management, the yields are modest. Cattle are raised on more than 600 farms in Montijo.

G. Land Tenure:

1. Titled land occupied by owner	196 farms=	2,721 has.
2. Rented land	130 farms=	468 has.

3. Land occupied without title 2,292 farms=87,986 has.
4. Mixed occupation 195 farms= 9,386 has.

H. General Agricultural Infrastructure:

1. Roads: Approximately 10 Km paved, 35 Km dry weather.
2. Credit: Total credit extended by BDA in 1978 for selected commodities was $422,000.
3. Agricultural Organizations: 12 asentamientos with 360 families.
4. Schools: There are two Ciclos Básicos with Agriculturally oriented curriculum. Montijo and Loma de Quebro.

VIII. LOS SANTOS

A. Location: Los Santos District of the Province of Los Santos is located in the Azuero Península on the Pacific side of Panama.

B. Target Population: 16,692 on 2,292 farms.

C. Topography: Range of elevation 0-230 meters predominantly plains and rolling hills.

D. Soils: (1) Type - Approximately 21,000 hectares of clay or clay-loam, undulating, heavy, residual soils weathered with moderate fertility. Approximately 700 hectares of deep alluvial fertile plains and another 700 hectares of heavier alluvial moderately fertile plains. Total land area = 42,500 hectares. (1971 Census of Agriculture).

(2) Potential Use - 668 hectares of I-A lands may be used for intensive annual crops such as vegetables, 704 hectares of II-A may produce annual crops such as rice or other grains. The 20,946 hectares of II-P land will not give high yields but is excellent for improved pasture. Mountainous areas are not suitable for agricultural purposes but some reforestation is possible.

(3) Total land in farms = 30,913 hectares. (1971 Census of Agriculture).

E. Climate: (1) Precipitation

a. 1000-1500 mm/yr.
b. Relatively low rainfall, distributed from June to November.
c. Severe 6-7 month dry season.

F. Agricultural Activities:

(1) Present - traditional crops and cattle (average of 36 head/farm. (1971 Census of Agriculture) Faragua major pasture grass. Winter milk production average for Azuero península is 3.5 liters/day/cow.**

(2) Future - A wide variety of crops including tropical vegetables could be grown under irrigated conditions with the proper manage-on I-A soils. Rice could be grown intensively on II-A soils. II-P soils should be used to produce improved pastures and support livestock production.

G. Land Tenure:

1.	Titled land occupied by owner	290 farms= 7,272 has.
2.	Rented land	228 farms= 691 has.
3.	Land occupied without title	1189 farms=11,704 has.
4.	Mixed occupation	585 farms=14,992 has.

H. General Agricultural Infrastructure:

1. Roads: Approximately 25 Km all weather roads - 75 Km of dry weather roads.
2. Markets: Commercial tomatoes are sold to the Compañia Panameña de Alimentos, S.A., an affiliate of Nestlé located in Natá. They make tomato paste which was exported for the first time in 1978.
3. Credit: Total credit extended by BDA to groups and individuals in 1978 for crops and livestock was $3,259,000. Much of the credit was for tomato production.
4. Agricultural Organizations: A total of 5 asentamientos and cooperative with 50 families involved.

**Carta Informativa Pecuaria. IDIAP. April, 1979. no. 6. p. 11

5. Schools: Ciclos Básicos in Guararé and Los Santos with agricultural orientation.
6. Agricultural Research: CATIE/ROCAP Project including diagnostic study of cattle production under way.
7. Related Activities: Chitre/Los Santos Regional Growth Center URBE project; Watershed Management in upper Rio La Villa Watershed.

TABLE 3.C.1.

FARM AND FARM LAND BY TENURE, FARM SIZE AND DISTRICT

Distric, Size (Hectares)	T o t a l		Titled Land Occupied by Owner		Rented Land		Land occupied Without Title		Mixed Occupation	
	Farms	Hect-ares	Farms	Hect-ares	Farms	Hect-ares	Farms	Hect-ares	Farms	Hect-ares
BARU	2,966	61,880	108	2,692	108	2,803	2,579	26,851	171	29,534
Less than 0.5	610	99	14	3	22	5	567	91	7	1
0.5 - 4.9	1,071	2,070	31	54	47	84	925	1,783	68	149
5.0 - 9.9	447	2,966	15	104	7	44	403	2,676	22	142
10.0 - 49.9	657	13,427	32	708	21	453	560	11,286	44	980
50.0 - or more	181	43,318	16	1,824	11	2,217	124	11,015	30	28,262
RENACIMIENTO	1,351	41,038	40	2,583	17	103	1,156	30,451	138	7,902
Less than 0.5	32	7	0	0	2	1	26	5	4	1
0.5 - 4.9	333	700	4	8	9	14	275	575	45	103
5.0 - 9.9	161	1,073	2	16	1	8	139	917	19	132
10.0 - 49.9	557	13,056	14	366	5	80	510	11,979	28	631
50.0 or more	268	26,202	20	2,192	0	0	206	16,975	42	7,035
BUCABA	5,525	73,692	642	21,805	233	4,042	3,900	26,832	750	21,013
Less than 0.5	1,473	117	73	10	51	7	1,334	95	15	5
0.5 - 4.9	2,052	3,590	207	355	146	218	1,373	2,340	326	677
5.0 - 9.9	628	4,183	75	511	13	84	440	2,904	100	684
10.0 - 49.9	1,045	22,311	190	4,556	9	228	659	13,121	187	4,406
50.0 - or more	327	43,491	97	16,373	14	3,505	94	8,372	122	15,241

Source: Censos Nacionales de 1970.
Vol. III Caracteristicas de las exportaciones agropecuarias.

TABLE 3.C.1.

FARM AND FARM LAND BY TENURE, FARM SIZE AND DISTRICT

Distric, Size (Hectares)	T o t a l		Titled Land Occupied by Owner		Rented Land		Land occupied Without Title		Mixed Occupation	
	Farms	Hect-ares	Farms	Hect-ares	Farms	Hect-ares	Farms	Hect-ares	Farms	Hect-ares
GUALACA	1,002	42,[illegible]3	51	4,340	60	5,096	763	19,726	128	13,421
Less than 0.5	81	13	1	1	31	4	48	9	0	0
0.5 - 4.9	259	432	14	19	20	22	198	337	27	54
5.0 - 9.9	106	743	10	70	2	14	86	598	8	61
10.0 - 49.9	354	8,037	7	145	4	126	299	6,506	48	1,260
50.0 - or more	203	33,358	19	4,106	3	4,930	136	12,276	45	12,046
SONA	3,117	97,631	332	26,014	225	1,781	2,255	46,216	305	23,620
Less than 0.5	143	20	21	4	5	1	117	15	0	0
0.5 -4.9	1,138	2,127	85	147	185	279	762	1,446	106	255
5.0 - 9.9	260	1,663	20	114	11	69	194	1,253	35	227
10.0 - 49.9	1,084	25,791	115	2,925	18	353	890	20,986	61	1,527
50.0 or more	492	68,030	91	22,824	6	1,079	292	22,516	103	21,611
MONTIJO	2,813	100,[illegible]61	196	2,721	130	468	2,292	87,986	195	9,386
Less than 0.5	846	19	45	4	4	1	796	15	0	0
0.5 - 4.9	837	1,461	79	109	117	160	551	993	90	199
5.0 - 9.9	273	1,726	20	122	5	25	221	1,408	27	171
10.0 - 49.9	539	11,481	39	801	3	40	453	9,618	44	992
50.0 or more	319	85,875	13	1,685	1	243	271	75,922	34	8,024

TABLE 3.C.1.

FARM AND FARM LAND BY TENURE, FARM SIZE AND DISTRICT

Distric, Size (Hectares)	T o t a l		Titled Land Occupied by Owner		Rented Land		Land occupied Without Title		Mixed Occupation	
	Farms	Hect-ares	Farms	Hect-ares	Farms	Hect-ares	Farms	Hect-ares	Farms	Hect-ares
LOS SANTOS	2,292	35,059	290	7,672	228	691	1,189	11,704	585	14,992
Less than 0.5	97	12	9	2	7	2	80	7	1	1
0.5 - 4.9	1,028	2,021	85	165	203	321	546	1,058	194	477
5.0 - 9.9	348	2,323	46	311	10	63	203	1,345	89	604
10.0 - 49.9	645	14,172	106	2,393	7	105	321	6,570	211	5,104
50.0 or more	174	16,532	44	4,801	1	200	39	2,724	90	8,807
CANAZAS	2,162	23,787	87	1,833	38	266	1,911	16,402	126	5,286
Less than 0.5	36	4	0	0	2	1	34	3	0	0
0.5 - 4.9	923	2,114	25	66	28	37	838	1,931	32	80
5.0 - 9.9	481	3,103	24	154	0	0	439	2,826	18	123
10.0 - 49.9	667	11,833	31	680	7	128	577	9,692	52	1,333
50.0 or more	55	6,733	7	933	1	100	23	1,950	24	3,750
SAN FRANCISCO	1,455	20,324	124	4,692	52	120	1,140	11,750	139	3,762
Less than 0.5	90	7	17	1	31	2	39	3	3	1
0.5 - 4.9	652	1,156	13	28	18	18	575	1,001	46	109
5.0 - 9.9	182	1,215	16	115	1	6	149	981	16	113
10.0 - 49.9	451	9,578	55	1,354	1	9	348	6,967	47	1,248
50.0 or more	80	8,368	23	3,194	1	85	29	2,798	27	2,291

TABLE 3.C.1.

FARM AND FARM LAND BY TENURE, FARM SIZE AND DISTRICT

Distric, Size (Hectares)	T o t a l		Titled Land Occupied by Owner		Rented Land		Land occupied Without Title		Mixed Occupation	
	Farms	Hect-ares	Farms	Hect-ares	Farms	Hect-ares	Farms	Hect-ares	Farms	Hect-ares
LA MESA	2,006	26,985	153	10,250	119	239	1,533	11,370	201	5,126
Less than 0.5	114	14	1	1	8	2	104	10	1	1
0.5 - 4.9	1,045	1,713	31	54	102	116	829	1,365	83	178
5.0 - 9.9	283	1,758	20	128	1	5	735	1,454	27	171
10.0 - 49.9	472	9,373	73	1,700	8	116	332	6,070	89	1,487
50.0 or more	92	14,129	28	8,368	0	0	33	2,471	31	3,290
SANTIAGO	3,978	68,164	531	20,141	253	1,623	2,542	30,085	652	16,315
Less than 0.5	263	42	37	6	14	2	207	33	5	1
0.5 - 4.9	1,773	2,730	153	215	215	245	1,136	1,761	269	509
5.0 - 9.9	555	3,518	85	530	12	68	362	2,258	96	662
10.0 - 49.9	1,144	23,376	187	3,848	7	125	741	14,314	209	5,089
50.0 or more	243	38,498	69	15,542	5	1,183	96	11,719	73	10,054

TABLE 3.C.2.

CREDIT AMOUNT AUTHORIZED FOR INDIVIDUALS AND GROUPS BY BDA OUTLET AND FOR SELECTED COMMONDITIES, 1978
(thousands of dollars)

	Individuals			Groups			
District Location BDA Branch Outlet	Crop Total	Live-stock	Indi-vidual Total	Crop	Livestock	Group Total	BDA Total
Baru (Progreso)	421	45	466	892	---	892	1,358
Bugaba (Concepcion & Volcan Branches)	1,257	344	1,601	41	---	41	1,642
Gualaca	73	124	197	34	8	42	239
Renacimiento	164	10	174	177	-	177	351
Los Santos (Chitre and Las Tablas)	1,707	680	2,387	622	250	872	3,259
Montijo	26	312	338	14	70	84	422
Santiago	104	657	762	303	206	509	1,271
Sona	16	542	558	804	427	1,231	1,789
Total	3,768	2,714	6,483	2,887	961	3,848	10,331

Source: Agricultural Development Bank.

TABLE 3.C.3.

ORGANIZED FARMING GROUPS BY PROJECT

Project Area	No. of Groups	Number of Families
RENACIMIENTO	6 Juntas Comunales	180
BARU	15 Asentamientos	500
BUGABA	5 Coops.	480
GUALACA	0	0
SANTIAGO	5 Asentamientos & Coops.	150
SONA	28 Asentamientos	840
MONTIJO	12 Asentamientos	360
LOS SANTOS	5 Asentamientos & Coops.	50
	TOTAL	2,560

Average Hectares/family: 12.2 has.

Average Arable Land/family: 3.3."

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* Data is estimated since project areas overlap official districts in which data is recorded.

DESCRIPTION OF IDIAP'S CURRENT AREA FOCUSED RESEARCH ACTIVITIES

1. Renacimiento District

Field work in the Caisan area of the Renacimiento District began in early 1978. A total of three diagnostic studies have been completed during the past twelve-month period to collect the majority of the socio-agronomic information needed. Thirty one on-farm experiments have been carried out or are underway on corn and kidney bean production problems. Numerous farm and agency meetings have been held, and 2 successful field days completed. MIDA has assigned 1 production agent full-time and BDA and other agencies are participating. Through a collaborative agreement, CATIE has assisted in diagnostic surveys, analysis of results, staff-orientation, and has recently assigned a full-time consultant in farming systems to this priority area.

With IDIAP's three full-time area staff members, the area field research/dissemination (AFRD) team totals six. In addition IDIAP's two multi-disciplinary applied research teams (5-9 members each, one concentrating more on crops and the second one on animal program research) will spend about 15% and 10%, respectively, of their time. The third multi-disciplinary team that will be formed within the next three years, and will concentrate more on integrated (crop/livestock) production systems and will probably spend about 20% of its time in Renacimiento area during the last 2 1/2 years of the project.

In addition, during the 5-year period approximately 14 production agents from MIDA, BDA, and Social Development Department will receive intensive training in area surveys, on-farm demonstration and farmer-group discussions; plus other aspects of expanded mass-media type dissemination of information activities and research in developing new methodologies in technology transfer.

Of the total 1,351 farms in the District, approximately 275 or 20% of them are in the selected initial priority area around the Plaza de Caisan in six different communities. Since most of these are members of organized groups, and since on-farm research, farmer group meetings, field demonstrations and field days, individual farmer visits, etc. have been underway for more than one year, at least 85% of the farmers already have had considerable contact with, and exposure to, the technology modification projects on corn and beans. In addition at least 200 farmers from neighboring communities

have had some contact with the area project through the field days, group meetings, on-farm demonstrations, published leaflets, seed production program, weed control short courses and field demonstrations, and other activities. Thus in this area an estimated 475 farmers or more than 35% of the total have thus far been exposed to, and many have participated directly in, the technology improvement processes. Thus far farmer participation has been very encouraging. Wider contacts with farmers are, however limited by a lack of mobility and a lack of resources to carry out additional experiments.

Actual on-farm experiments began in October, 1978 in collaboration with ten farmers dispersed in four contiguous localities within the District of Renacimiento. (Alto de Las Minas, Fila de Caisan, Plaza Caisan, and Centro Caisan, 2-2-3-3). These ten farmers were selected after the completion and analysis of two area surveys, several technician/farmer groups discussions, additional specific farm survey and soil tests. Other factors influencing the selection of cooperating farmers included their expressed enthusiasm to participate, distribution of the farms throughout the priority area, accessibility, plus the consideration that the farms and farm families were quite representative in the area in respect to size, commodities produced, farming systems practiced, experience, education, available labor, and other agro-socio-economic factors.

The ten farms consist of, on the average approximately nine hectares of land in crops plus another eight hectares of wooded, pastured, or untillable land. Several of them have small patches of coffee (very low production) on the steeper slopes. In addition to corn and kidney beans (Phaseolus vulgaris .), which are the principal crops in the area, all of the participating farmers, as do the majority of farmers in their area, produce other commodities including beef, milk, pigs, chickens, rice, coffee, bananas, and yuca. Because of a number of factors, such as the outstanding importance of corn and bean production in the area, the national demand of corn and beans (both are imported at present in significant quantities), the shortage of trained research personnel, and financial limitations, an institutional decision was made to concentrate in the first stages of this area project on solving the major production constraints on corn and beans

As an example, this is by far the most important producing area for kidney beans. Panama is importing annually about 1,500 metric tons of beans, or the equivalent of 3,000 hectares production at 1,000 pounds per hectare. The objective is to more than double the present area in production (1,000 has) and increase production per hectare by 50-60% (present average is 1,000 pounds) with a minimum increase in production costs. This would eliminate the need

for importation. Of course as consumer demand increases, the research, dissemination and production programs will have to keep pace.

A total of sixteen on-farm trials were carried out on kidney bean production between October, 1978 and February 1979. These trials included three on weed control methods, three on soil productivity and fertilizer experiments, two on varying the crop density, two on methods and time-spacing of nitrogen application, three on variety and segregated lines testing of plant material from CIAT, and the other three were on varietal production comparisons, seed increases, and seedbed preparation.

In early May of this year fifteen on-farm research experiments in corn were initiated on ten selected farms in Alto La Mina (3), Plaza Caisan (5), and Centro Caisan (2). Four of these farmers also are cooperating in the kidney bean investigations. The on-farm research includes a series of combined experiments evaluating limiting production factors (crop density, weed control methods, fertilizer use and methods of application, planting dates, and seedbed preparation), variety trials, use of herbicides (methods of application, time-phased, materials, training sessions, etc.), crop management practices, and minimum tillage. Next season, CIMMYT will collaborate further on field investigation to reduce the height by one meter of the high-producing popular local corn variety. This will reduce field losses, amount of fertilizer required, and facilitate harvesting.

2. IDIAP's Current Research Activities in the Cerro Punta Area of the Bugaba District Focus on Potato Production.

Although the research program in potatoes was started several years ago, and although at present the nation is self-sufficient in potatoes, numerous production problems still remain to be solved. For example very recently the average net profit per hectare started declining because of high costs of imported seed, the decline of soil fertility due of very serious erosion, and the adoption of many imported practices without considering carefully the economic aspects and the disturbance of the ecological balance. Some producers use as many as ten different chemicals for pest control in one growing season.

At present IDIAP's technology generation and dissemination program consists of on-farm and station plot research on producing high-quality disease-free seed potatoes, several experiments on controlling nematodes, trials and demonstrations on crop

rotation and soil conservation, variety trials, and pest management investigation.

Plans for the next five years call for:

1) Testing and introducing new varieties and hybrids for better disease and storage resistance, more uniform sizes, and good producers. Varieties developed in Holand, Canada, Mexico, and CIP (Peru), will be tested and the most promising ones will be multiplied for greater farmer evaluation trials.

2) Carry out soil fertility, erosion control, and fertilizer trials in collaboration with five farmers.

3) With four producers each year, intensify the integrated namatode research projects.

4) Introduce and help implement an area-wide program of integrated pest management.

5) During each production cycle collaborate with at least three farmers in maintaining on-far demonstrations of recommended combined technology modifications aimed at solving the major production constraints.

Research in potato production is also being assisted by the Swiss Government which is contributing $125,000 over a five-year period, administered by CIP, as a part of a regional research program. The purpose of this program is specifically to help improve research on golden nematode control in potatoes. These funds will be used on training fellowships, special field and laboratory equipment and materials, data processing, etc.

In addition to the potato program, research and on-farm trials and demonstrations are now underway with onions, along with other vegetable crop (carrots, cabbage, etc.) rotation, variety trials, and crops improvement programs. Research on onions is being concentrated on varietal testing for more in-storage resistance and better production types, bulb production, pest management, and in-storage experiments. When IDIAP's infrastructure, research equipment, and staff training has been improved, all of the above efforts will be increased. Some of the vegetable growers cooperatives around Boquete have repeatedly reuqested assistance in solving their problems.

In addition to IDIAP's two full-time technicians and one from MIDA, another production agent from MIDA will be added this year,

making total of four on the area field team. The crops multidisciplinary team spends about 10% of its time in this priority area, and IDIAP's nematode research specialist spends about 35% of his time there. During the 5-year projects period at least seven production/change agents will participate in intensive training programs.

All of the 250 participating potato producers, who are members of potato growers cooperatives, have had considerable exposure to the improved technology activities. These 240 producers, with 1-10 hectare farms, in addition to producing potatoes also produce in rotation or within their farming systems, other vegetables and some fruits (carrots, cabbage, cauliflower, tomatoes, strawberries, citrus fruits, etc.) For the past three years IDIAP, MIDA and the cooperatives have collaborated in a production improvement program. A farm record system and annual survey reviews reveal that a high percentage of the participating farmers have greatly increased their land and labor productivity resulting in a per farm net profit increase of more than 50%. During the past two years about 30 of them have participated in a potato seed production program, in which locally produced quality seed potatoes are being profitably marketed for $16-18 per 50-pound crate, as compared to an imported (Holland) price of $35-40. It is estimated that more than 250 additional farmers in the Bugaba district have been exposed and have benefitted to some degree by reading published bulletins and information leaflets, purchasing seed potatoes, attending field days, from radio bulletins and newspaper articles, and by visiting on-farm trials and neighboring farms that have adopted some of the improved technology. Thus approximately 10% of the Bugaba area farmers have been exposed and are at least partial adopters of the improved technologies. With the additional staff training programs and more transportation, a much higher percentage of the farmers can be reached.

3. Gualaca, Montijo and Los Santos District

Three other areas in which some progress has been made are Gualaca, Montijo, and Los Santos. The multidisciplinary team for these three areas thus far have been concentrating on dual-purpose animal (beef/milk) production problems. It is planned that within the next two years, additional components including small ruminant production and integrated crop/livestock production systems will be incorporated. Same diagnostic surveys have been completed and analyzed with assistance from CATIE, priority productivity constraints identified, and modeltype farms are being established to begin on-

farm research and introduction of improved technologies For each area three major prevailing production systems are being studied for problems and appropriate improvements. Three farmer participants for each production system in each of the three areas will collaborate, making a total of 27 farmers in this phase of the project. In addition a very successful field has been conducted in each area. Before the field days, each farmer in the area was visited, given an invitation with his name on it, and explained the purpose of the field day and the area project.

In addition to the multidisciplinary team, which is spending at least 20% of its time in each of these three area, two full-time technicians (B.Sc. or Agronomo level) from IDIAP are on location. When MIDA's two technicians are assigned, the area field Research/Dissemination team will have four members. In addition, through a recent collaborative agreement, under ROCAP and BID financed projects, CATIE will place two full-time resident staff members for concentration in these areas. One of these will be a specialist in "milk production for small ganaderos with limited resources". The other will be a specialist in animal production systems for small farms. It is estimated that each of these will spend at least 20% of his time in each of the three areas, 30% in the other five years, and 10% for report writing and administrative duties. Both will be appointed this year and will remain approximately four years. In addition, IDIAP has added three additional staff members who will serve as counterpart to the CATIE technician.

Although all three of these areas have some crop production, because of their importance, and the importance of the regions surrounding the project areas, in milk and beef production, concentration at present is focused on these two commodities. By the third year of the project, the combined crops/animal production multi-disciplinary team will begin working intensively in these and other areas towards investigation, promotion, and dissemination in more integrated farming systems to help increase land and labor productivity.

Of the three areas Gualaca has heretofore received much more attention, and has shown more progress in adopting new and modified technologies, since IDIAP's main animal/pastures research station is located with the District. In this area at least 35% of the 400 farms have adopted some of the recommended improved practices and technological components. These include use of improved pasture grasses such as Tanner or Star Grass, pasture rotation and fertilization, use of herds of Zebu crossed with Holstein or Brown Swiss (up to 1/2) for higher milk production and better feed conversion,

use of feed supplements feeding, and improved herd management and sanitation with the construction of corrals and milking sheds. Many farmers are obtaining an increase of 3 liters of milk per cow per day (doubling production from 3 to 6 liters/day) by adopting the introduced technology of cut-feeding of king grass mixed with 3.25 pounds of urea and 5 ounces of fish meal. With this system about a 50% return of investment is being achieved.

Significant gains are also being obtained on the experiment station model farm, on collaborating farms, and on some farms that have adopted the improved technology of:

1) Feeding sugar cane as cut feed or as silage, along with some rice hulls and urea.

2) Feeding hay made from rice stalks and tanner grass along with Mel-Urea, fish meal and molasses.

3) Feeding rice straw and rice hulls (20 lbs.), along with 6 lbs. of Mel-Urea, 3/4 lb. of fish meal, and 1/4 lb. of Urea.

Additional economic studies are underway on these system components and others.

In the areas of Montijo and Los Santos, the programs are less than one year old. They can not be fully implemeted until additional resources are made available. Therefore, it is too early to get any accurate estimate of area impact. As stated before, farmer interests and collaboration is high in both areas, with good response and participation in group meetings, surveys, farmer visits, field days, and in establishing on-farm trials.

ECONOMIC ANALYSIS

A. Economic Feasibility Methodology

Research projects are difficult to justify economically because the end result is basically unpredictable. Since projections of results are so difficult, traditional benefit-cost analyses which depend upon a stream of incremental income increases in the future cannot be accurately estimated. Much of the agricultural research conducted on a worldwide basis has been evaluated at its conclusion and found to be beneficial, as pointed out earlier. In fact, the payoff in some cases has been truly remarkable. There is little question that research represents one of the soundest investments a country can make. This is particularly true of agricultural research in countries, such as Panama where technology levels are still extremely low.

Two composite farms were developed to estimate returns to technology generation and dissemination: one for crops and one for livestock. Owing to the impossibility of illustrating the future conformation of the thousands of farms to be served by the project, we have selected the two composite farms as indicative models for the purpose of analysis. They are intended to demonstrate the magnitude of the change in income that could be achieved from a variety of farms or production functions. These composite farms were constructed on the basis of several case studies by USAID consultants and IDIAP staff members and a special localized farm level survey by IDIAP in collaboration with CATIE.

B. Composite Farm Analysis

The "before and after" composite farm approach was selected for analysis of costs and benefits. A description of the composite farms is presented below.

Due to the absence of any comprehensive farm level survey data, it was decided that a composite farm approach be adopted. The basis for the composite farms was several case studies conducted by USAID consultants and IDIAP Staff members as and a special localized farm level survey by IDIAP in collaboration with CATIE as well as consultation with IDIAP and MIDA personnel. In order to be more descriptive the composite crop farm was placed in the mountains of northwest Panama and the livestock farm in southwest Panama. A detailed description of the composite farms is presented below.

1. The Composite Crop Farm

a. Location

This farm is in the interior uplands of mountainous western Panama, near the Costa Rican border. It is quite isolated; the nearest paved road and town of any size in 25 Km. There are no health services in the community. The road leading to the farm is extremely poor but is now being improved under an AID financed rural access road project. Yet despite these problem, this region is regarded as an area considerable farming potential. There are some good soils which are suited for a variety of crops - corn, dry beans, vegetables, citrus fruits, coffee, etc. Access to water is good and the area has more moderate temperatures, and less extreme periods of drought than many regions in Panama. Improved pastures and dairy production are seen to offer good possibilities in the moderately hilly terrain, and beef cattle for the steeper slopes. Coffee is a common hillside crop. The people are regarded as relatively progressive, and appear to be eager to adopt newly tested and validated improved farming practices.

b. The Farm Family

The composite farmer is about 30 years old, has five years of schooling, and works on the farm full time. His wife has fewer years of education, and helps with the farm work. Neither has off-farm income sources. The couple has two children both under six years of age.

c. The farm

This farm, consisting of 10 hectares of undulating land, is owned by the farmer and at present 6 hectares are in crops and 4 are not being used. Four hectares have been cropped continously with corn, followed by dry beans, each season. (The income generated by the traditional system is presented on Table 1.). On the remaining 2 hectares of cropland, coffee trees are scattered among trees and undergrowth. There is no modern equipment on the farm - only a few basic hand tools. The value of farm capital (land) would not exceed $4,000.

Much of the labor is supplied by the farmer and his wife, but he does hire some labor on a day-to-day basis to help with the corn, beans, and coffee. Every season he hires a tractor to plow and disk the four hectares for corn and beans. He buys seeds and some herbicides. He has to pay for transporting his produce to market. He does not use fertilizer.

d. Appropriate Technology

Development of appropriate technology by IDIAP will take many stages and will apply to much more than corn, beans, and coffee which are the enterprises selected for the composite farm. Obviously, if the results of the research for generating appropriate technology were now available, this project would not be needed. However, it is possible to speculate on the possible out come of some of the research particularly if such speculation involves techniques that have been rather widely developed and accepted in other countries. With this in mind, we utilized an approach called "minimum technology modification" on the composite farm in order to provide a basis for a benefit-cost analysis. The term "minimum" cannot be overstressed, since nothing sophisticated is proposed nor is there a need for formal credit programs to assist in the initial adoption of the improved technology.

e. Proposed Changes

IDIAP Technicians have proposed that a farm like the composite farm be introduced to new technology over a 10-year period, divided into five two-year stages. Traditional practices continue in stage I and improved practices will be gradually introduced over stages II - V. The changes for each stage are as follows:

Stage II

1. Improved weed control for beans
2. Chemical weed control on corn
3. Improved seed for beans

Stage III (State II changes continue)

1. Use of mixed fertilizer on corn and beans

Stage IV (Stages II and III continue)

1. Beans seeded with improved spacing
2. Use of Urea on corn

Stage V (Stages II - IV continue)

1. Introduction of chemical weed control for beans
2. Introduction of fungicides and pesticides for beans
3. Introduction of hybrid corn seed

f. Costs and Returns

Annex Tables 2 and 3 summarize the costs, returns, and net income generated by introduction of the appropriate technology. The incremental income effect of the crop program is shown in Annex Table 5.

2. Composite Livestock Farm

a. Location

The farm is located in southwest Panama, perhaps in the Province of Los Santos. The region has a rainy season (June to November) with 2000-2500 mm of rainfall and a dry season (December to May) with virtually no rainfall. The topography of the region varies from undulating to mountaneous and the livestock farms are generally located in the more hilly sections. The soils in these sections are poor, shallow and acidic. For these reasons they are not good for crops and are used primarily for pasture.

b. The Farm

The farm is located on an unpaved secondary road and is 10 kms from the principal road of the region and 60 kms. from the Interamerican highway. The farmer has 30 ha. of land which is subject to erosion and has shallow acidic soil. It is currently planted in native pasture (Faragua) Hyparrhenia rufa. Extensive management techniques are used and no fertilizers. During the dry season the quality of the pastures is poor. The farm family has four members and can provide 1.5 person/years of labor per year. He also used some hired labor.

The existing farm is as follows:

Fixed Capital	Units	Value/Unit	Total Value
Land	30 ha.	$200	$6000
Fence	4500 m.	.50	2250
Canal	1	200	200
Milk Cans	2	60	120
Portable Pump	1	90	90
Livestock Inventory			
Cows	20	250	$5000
Heifers	4	200	800
Steers	4	175	700
Male Calves	4	100	400
Female Calves	4	100	400
Bull	1	350	350
Horses	2	100	200
			$16,510

c. Description of Livestock System

The farmer uses extensive management. Pastures are rotated every 15 days on a 60 day cycle with no use of fertilizer. No supplementary feeding is done except for common salt which is available year-round. Due to the problems with pastures in the dry season, milk production drops and may actually stop in February. The only health and sanitary practices used are vaccination of calves and treatment of external parasites. The following production indices apply:

Annual animal extraction rate (sales)	11-13%
Birth rate	50%
Herd mortality rate	5%
Milk Production (liters/cow/day)	3.5
Days of Lactation	141
Meat production	
Cull cows kg/yr	364
Steers kg/yr	272
Calving interval (months)	23
Slaughtering age (years)	3.4

The cattle are generally a mix of zebu, Holstein, and Brown Swiss. On the average over a year, 10 cows are being milked and 10 are dry.

d. Costs and Returns (Traditional)

The costs and returns associated with the traditional system are presented in Annex Table 4. This is labeled Stage I and no change is assumed for the first three years due to start-up time required to expand IDIAP research.

e. Proposed Changes

For purposes of the analysis, it is estimated that the changes should be introduced over a 10 year period (divided into three stages, with stage I leaving the farmer with traditional practices).

Improved practices will be introduced after the third year, and through stages II and III. Stage II will take three years, and Stage III, four years. Some credit will be required for Stages II and III. The changes for each stage are as follows:

Stage II:

1. Mineral mixture supplementation through the whole year.
2. Planting of 1 ha. of King grass (Penniseturn purpurlum PI-300-086) for cutting and ensiling.
3. Planting of 0.5 ha. of Pangola grass (Digitaria decumbens) for calves to graze.
4. Low level fertilization of the "Faragua" pasture.
5. Improvement of pasture utilization through an improved rotation system.
6. Energy and protein supplementation during the dry season.
7. Use of drugs to eliminate internal parasites.

Stage III:

1. Replace 5 ha. of "Faragua grass" with Pangola grass.
2. Increase fertilization rate by 50% on all pastures.
3. Improve the rotation of pastures through the use of more subdivisions of the pastures.
4. Increase the rate of supplemental feeding.
5. Establish a helath policy throughout the year.

After 10 years the following production indices would apply:

Annual animal extraction rate
Birth rate
Herd mortality rate
Milk production (liters/cow/day)
Days of lactation
Meat production
  Cull cows kg/yr
  Steers kg/yr
Calving internal (months)
Slaughtering age (years)

f. Costs and Returns (Stages II and III)

The costs, return, and net income for the composite livestock farm after appropriate technology modification are presented in Annex Table 4. Total incremental income of the livestock program is presented in Annex Table 5.

C. Benefit - Cost Analysis

The total number of small and medium size farmers in the eight areas included in this project is 22,152, of this number, approximately one-third are farms engaged primarily in the production of livestock and dairy products. The remaining 2/3 are primarily crop farms but could have some livestock. Using the ratio of crop to livestock farms, 1/3 of the full adopters were assumed to be livestock farmers and 2/3 crop farmers.

If all farmers were adopters of minimum level appropriate technology after 10 years, the total benefits would be about 76 million (PV). However, no one can reasonably expect anything near 100% participation in just 10 years. USAID consultants and personnel from IDIAP and MIDA have estimated that it would be reasonable to expect a 30% or more full adoption rate (full adoption implies that the farmer has reached the target yields by Stage V in crops and by Stage III in livestock.

It should be stressed that the assumed level of technology on the composite farm and the percentage of adopters in 10 years are considered to be at minimum levels. Thus the B/C ratios should be valid minimums even though the use of a composite farm approach is less than ideal and even though it is somewhat difficult to anticipate precise levels of development, dissemination, and adoption of appropriate technology.

The selection of a minimum technology modification precluded the possibility that IDIAP research would develop technologies which produce income streams far in excess of those on the composite farms. In addition, recall that the composite crop farm had 4 unused hectares and 2 acres of very poor coffee. Given some credit, the farmer could have improved his coffee and expanded his production of corn and beans or even diversified into vegetables and animal production. All of these components will be investigated by IDIAP through its production systems/farm management approach.

The assumption that a minimum of 30 percent of the target group would be full adopters in 10 years understates the benefits that will result from the project since it is most likely that the remaining 70% will be partial adopters. Hence, in order to capture the benefits from both full and partial adopters for the Benefit/cost analysis, the benefits from the approximately 70% partial adopters were assumed to be equivalent to 10% full adopters, thus raising the full adoption percentage to 40% (Table 5).

d. Other Benefits

Import substitution is likely to be another benefit to this

project. Panama is currently importing corn, milk products, potatoes, beans, onions, edible oils and pork as well as several processed food products (See Annex IV). The foreign exchange earnings saved by becoming self-sufficient in these products could be considerable. In addition, the possibility for expansion of agricultural exports exists. Panama currently exports beef, condensed milk, and recently, some rice. Other markets could conceivably be developed in the future.

IDIAP also plans, as part of its emphasis on farm management research to explore the development of appropriate technology to control farm level post production losses. Currently such losses are estimated now to be as high as 15-35 percent on some commodities. Again, positive benefits not included in the B/C calculations would result if such losses could be reduced.

Improved production practices are generally associated with improved conservation of natural resources. This can be an important benefit in many areas of Panama where soil erosion is becoming severe. In addition, the improved production practices proposed for this composite farms results in an increase in labor needs. In most families, this will require hired labor. Thus, the program is expected to generate new employment opportunities for the landless rural poor. Finally, IDIAP envisions the introduction of vegetable plots on many of the target farms. Nutrition benefits should result.

None of the above listed other benefits were able to be quantified. However, if it were possible to accurately estimate such net benefits, the B/C ratios would be significantly higher.

TABLE I

Cost and Returns Breakdown for Corn and Beans, Traditional System.

Activity	Stage I
Corn and Beans (4.0 ha)	
Returns:*	
32 qq of beans at $43.50	$ 1392
80 qq of corn at $6.50	520
6 qq of coffee at $90	540
	$ 2452
Cost:	
Tractor hire (24 hrs. at $12)	$ 288
Bean Seed (5 qq at $75)	375
Corn Seed (1 qq at $10)	10
Hired labor (130 man/days at $3)	390
Cost of Transport (Corn & Beans $1/qq)	85
Replacement of basic tools	10
	$ 1158
Net Income	$ 1294

* Yield using traditional methods are 20 qq/ha for Corn and 8 qq ha for beans.

TABLE 2

Detailed Cost Breakdown for Corn and Beans
Assuming Use of an Appropriate Technology.

Activity	Stage 2	3	4	5
Corn and beans 4.0 has				
Land preparation, 24 hrs. at $12/hr)	288	288	288	288
Hired labor for seeding corn (4 days/ha. at $3/day).	48	48	48	48
Hired labor for seeding bean traditional (4 days/ha at $3/day).	48	48	---	---
Hired labor for seeding beans with improved placement(6 days/ha at $3/day).	--	--	72	72
Hired labor, weed control, beans.	240	240	240	84
Chemical weed control on corn				
a) Purchase of sprayer	156	---	---	---
b) Herbicide at $21.75/ha.	87	87	87	87
Introduction of chemical wee control, at $21.75/ha.	---	---	---	87
Fungicide and pesticide, beans,$24/ha.	---	---	---	96
Use of mixed fertilizer of corn and beans (4qq.+3qq/ha. at $14/qq).	---	393	393	393
Use of urea of corn (2qq/ha at $12.75/qq)	--	---	102	102
Local seed for corn (0.3qq/ha at $10.50/qq).	12	12	12	---
Improved seed for bean (1.25 qq/ha at $75/qq).	375	375	375	375
Harvest and shucking labor for corn $.875/qq).	105	140	175	210
Harvest and threshing labor for beans ($3.00/qq).	132	168	204	240
Transport of corn and beans(at $1.qq).	164	216	268	320
Total corn and beans costs	1655	2015	2264	2468

TABLE 3

Projected Yields, Returns, and Net Income for Corn and Beans assuming use of Appropriate Technology

Activity	Stage			
Corn and Beans (4.0 ha) yield (qq/ha)	II	III	IV	V
Corn	30	40	50	60
Beans	11	14	17	20
Returns:				
Corn	$780	$1040	$1300	$1560
Beans	1914	2436	2958	3480
Coffee	540	540	540	540
Total Returns	3234	4016	4798	5580
Net Income :				
Total Returns	3234	4016	4798	5580
Total Cost	1655	2015	2264	2468
Net Income	1579	2001	2534	3112
Additional Income Attributed to Appropriate Technology	285	707	1240	1818

TABLE 4

Cost and Returns Breakdown for the Composite Livestock Farm, Traditional and with Appropriate Technology, 10 years.

ITEM	Stage I 1979 - 1981	Stage II 1982 - 1984	Stage III 1985 - 1989
INCOME			
- Milk Production a/ ($0.165/lt.	814	1782	4633.50
- Beef b/	1400	3050	4750.00
TOTAL INCOME	2214	4832	9383.50
COSTS			
- Commont salt ($0.10/kg.)	10	20	20
- Mineral mixture	--	130	130
- Vaccines	2.50	2.50	2.50
- Drugs	6.00	56	56
- Improved pasture Establishment*	--	360	1200
- Tools	100	100	100
- Fertilizers	--	1026	1539
- Fences	--	50	150
- Machine lease	--	200	200
- Feed Supplements	--	308	616
- Hired labor	300	360	360
TOTAL COSTS	418.50	261.50	4373.50
NET RETURN	1795.50	2219.50	5010.00
INCREMENTAL INCOME	---	424	3214

* Includes cost of additional labor.

Notes: a / Days of lactation x yield in liters x price/liter = Milk Gross Income.

b / Extraction rate x average weight/annual x price/kg= Beef Income.

TABLE 5

Calculation of the Benefits to be Derived from the Project by Extrapolating the Results of Composite Farms to the Entire Project Area 1/

A. Crop Farm Benefits 2/

Yr. and No. of Farms		First dy	one-third Sub-Total	Second dy	one-third Sub-Total	Last dy	one-third Sub-Total	Total Income Change Cols. 3 + 5 + 7
1								
2								
3	1959	$ 285	$558,315					$558,315
4	3918	$ 285	$558,315	$ 285	$ 558,315			$1,116,630
5	5936	$ 707	$1,385,013	$ 285	$ 558,315	$ 285	$558,315	$2,501,643
6	5936	$ 707	$1,385,013	$ 707	$1,385,013	$ 285	$558,315	$3,328,341
7	5936	$1240	$2,429,160	$ 707	$1,385,013	$ 707	$1,385,013	$5,199,186
8	5936	$1240	$2,429,160	$1240	$2,429,160	$ 707	$1,385,013	$6,243,333
9	5936	$1818	$3,561,462	$1240	$2,429,160	$1240	$2,420,160	$8,419,782
10	5936	$1818	$3,561,462	$1818	$3,561,462	$1240	$2,429,160	$9,552,084
11	5936	$1818	$3,561,462	$1818	$3,561,462	$1818	$3,561,462	$10,684,286

1/ The income change figures (dy) are derived in Table 3.

2/ Total number of crop farms to fully adopt technology by 11th. year:

.40 x 14,842 farms = 5936 farms

We assume that it will take three years before Technical Assistance reaches all the adopters and that as a consequence incomes will change on a staggered basis as shown above:

5936 farms x .33 = 1959 farms

TABLE 5 (Continued)

B. Livestock Farm Benefits 1/

Yr. and No. of Farms		First dy	one-third Sub-Total	Second dy	one-third Sub-Total	Last dy	one-third Sub-Total	Total Income Change Cols. 3 + 5 + 7
1								
2								
3								
4	965	$ 424	$409,160					$ 409,160
5	1930	$ 424	$409,160	$ 424	$409,160			$ 818,320
6	2924	$ 424	$409,160	$ 424	$409,160	$ 424	$409,160	$1,227,480
7	292	$ 804	$775,850	$ 424	$409,160	$ 424	$409,160	$1,594,180
8	2924	$1608	$1,557,720	$ 804	$775,860	$ 424	$409,160	$2,742,740
9	2924	$2412	$2,327,580	$1608	$1,557,720	$ 804	$775,860	$4,661,160
10	2924	$3215	$3,102,475	$2412	$2,327,580	$1608	$1,557,720	$6,987,775
11	2924	$3215	$3,102,475	$3215	$3,102,475	$2412	$2,327,580	$8,532,530
12	2924	$3215	$3,102,475	$3215	$3,102,475	$3215	$3,102,475	$9,307,425

1/ The income change figures (dy) are derived in Table 4.

One adjustment in Table 4 was made: The Table shows that the $3215 income change figure occurs immediately in the sixth year. For our purposes here, we have assumed the change from $424 to $3215 will take four years. Hence the B/C results shown in Table 7 are understated to the extent that the $3215 figure is attained before the seventh year.

2/ Total number of livestock farms to fully adopt technology by twelfth year:

.40 x 7310 farms = 2924 farms

Assuming a staggered 1/3 adoption rate as in the crop farm analysis:

2924 farms x .33 = 965 farms

TABLE 6

BENEFIT COST ANALYSIS OF CROP FARMS UTILIZING APPLIED RESEARCH TECHNOLOGY 1/

YR.	COSTS 2/	BENEFITS 3/	DISCOUNT FACTOR (15%)	PV COSTS Col 1 x 3	PV BENEFITS Col 2 x 3
1	$1,876,000	-0-	.870	$1,632,120	$ -0-
2	1,876,000	-0-	.756	1,418,256	-0-
3	1,876,000	$ 558,315	.658	1,234,408	367,371
4	1,876,000	1,116,630	.572	1,073,072	638,712
5	1,876,000	2,501,643	.497	932,372	1,243,317
6	500,000	3,328,341	.432	216,000	1,437,843
7	500,000	5,199,186	.376	188,000	1,954,894
8	500,000	6,243,333	.327	163,500	2,041,5,0
9	500,000	8,419,782	.284	94,667	2,391,218
10	333,333	9,552,084	.247	82,333	2,359,365
11	166,667	10,684,386	.215	35,833	2,297,143
12	-0-	10,684,386	.187	-0-	1,997,980
13	-0-	10,684,386	.163	-0-	1,741,555
14	-0-	10,684,386	.141	-0-	1,506,498
15	-0-	10,684,386	.123	-0-	1,314,179
		T O T A L		$7,070,561	$21,291,645

$$B/C = \frac{\$21,291,645}{7,070,561} = 3.01$$

1/ These results are obtained by extrapolating the composite farm results to the entire project area. We have carried-out the analysis over a 15 year period because total income change does not occur until the 11th year, and because the benefits that clearly are attributable to the project are quite substantial even when discounted for years 12-15. Inspection reveals that the B/C ratio would be 2.1 at the 11th year.

2/ The total project cost is $14 million. We assume that crop farms will constitute two-thirds of all farms served;(14,841 crop farms); hence project costs attributable to these farms would be: .67 x $14 million = $9.38 million. We then assume these $9.38 million project costs are distributed evenly over the first five years which gives the $1,876 million used above. Finally, we assume that from the sixth through the ninth years $500,000 will be spent to continue the technical assistance to all 14,841 crop

farms, and then, as farms attain the maximum expected yearly income change due to the project ($1,818), technical assistance (TA) no longer will be needed. Hence, at the tenth and eleventh years the cost diminish to reflect the remaining farms needing TA (9,894 and 4,947 respectively). From the twelfth year-on no TA is assumed to be needed since all farms have attained the maximum income change.

3/ See Table 5 for explanation of Benefit derivations.

TABLE 7

BENEFIT COST ANALYSIS OF LIVESTOCK FARMS UTILIZING APPLIED RESEARCH TECHNOLOGY 1/

YR.	COSTS 2/	BENEFITS 3/	DISCOUNT FACTOR (15%)	PV COSTS Col 1 x 3	PV BENEFITS Col 1 x 3
1	$924,000	$ -0-	.870	$ 803,880	$ -0-
2	924,000	-0-	.756	903,880	-0-
3	924,000	-0-	.658	607,992	-0-
4	924,000	409,160	.572	528,528	234,040
5	924,000	818,320	.497	459,228	406,705
6	250,000	1,227,480	.432	108,000	530,271
7	250,000	1,594,180	.376	94,000	599,412
8	250,000	2,742,740	.327	81,750	896,876
9	250,000	4,661,160	.284	71,000	1,323,769
10	250,000	6,987,775	.247	61,750	1,725,980
11	166,667	8,532,530	.215	35,833	1,834,494
12	83,333	9,307,425	.187	15,583	1,740,488
13	-0-	9,307,425	.163	-0-	1,517,110
14	-0-	9,307,425	.141	-0-	1,312,347
15	-0-	9,307,425	.123	-0-	1,144,813
		TOTAL		$3,566,088	$13,266,305

$$B/C = \frac{\$13,266,305}{\$3,566,088} = 3.72$$

B/C Analysis for Both Crop and Livestock farms:

$$B/C = \frac{\$21,291,645 + \$13,266,305}{\$7,070,561 + \$3,566,088} = 3.24$$

1/ These results are obtained by extrapolating the composite farm results to the entire project area.

2/ .33 x $14 million ÷ 5 yrs. = $924,000/yr.

3/ All farms reach maximum incremental income change in 12th year. See Table 5 for explanation of Benefit derivations.

4/ See foot notes to B/C Analysis of Crop Farms for more information.

SOCIAL SOUNDNESS ANALYSIS FOR APPLIED AGRICULTURAL RESEARCH

A. Overview.

Research and dissemination activities to be undertaken by the Applied Agricultural Research Project will be conducted in several geographic regions of Panama and will encounter distinct cultural and social situations. Studies recently conducted in conjunction with the social soundness analyses of the Access Roads, the Watershed Management and Integrated Rural Development Projects are relevant to the areas to be involved in this Project and their findings are incorporated into this analysis. In particular, the analyses of the Renacimiento and Los Santos regions are illustrative of the range of social structures which exist in the project areas. The socio-economic patterns analyzed in the two illustrative areas are present, with some modifications, in the other areas as well. Critical economic, detailed social and cultural data on the target population are being collected in all Project areas as the initial phase of the research project. Information concerning farming practices and technical problems will be collected prior to designing research and dissemination activities. These diagnostic surveys will be conducted by a multi-disciplinary team (including a sociologist) in each Project area.

B. The Target Population Description.

The primary participants of the Project will be from among approximately 22,000 small and medium size farmers who are involved in crop, animal and milk production within eight project areas in three provinces of Panama. They can be divided in four groups: the small farmers, farmer-ranchers, group farmers and rural residents. Small farmers are defined as those farming between 0.5 and 10 hectares who cultivate crops (and have at most three head of cattle).

Farmer-ranchers primarily engaged in extensive ranching but also generally engage in a small cropping activity. The size of these agricultural units ranges from 10 to 50 hectares with a maximum of one animal unit per hectare. In terms of their current net income, however, these rancher-farmers fall into the "small" farmer target group. Depending on land quality, they are able to maintain only 0.5 to 1.0 animal units per hectare.

Group farms (asentamientos) which have been established with direct government support and supervision, are composed of from

15 to 60 members who previously were small farmers or rural residents. According to a recent IBRD report the average income per worker generated on asentamientos was $250 in 1977 (excluding imputed income from individual subsistence plots).

Despite the distinctiveness of these three farm types, there are several attributes common to all which in turn justify the selection of these priority groups. These attributes are: low productivity of the factors of production, outdated or inappropriate production technologies and inadequate access to improved means of production. These farm types constitute the direct beneficiaries of the improved agricultural technologies which are the result of project activities.

Farmers with less than 0.5 hectares of land are considered to be "rural residents" and as a general rule work primarily as agricultural laborers. Rural residents will benefit from project activities through the increased demand for unskilled agricultural labor generated by the new technological practices.

1. Small Farmers.

This group of farmers will be defined as those who operate farms of less than 10 hectares and are primarily occupied in agriculture. Within the eight project areas there were approximately 11,000 such farms in 1971 and it is expected that there has been almost no increase since then. (However, in recent years a considerable number of these farmers (perhaps 1,000), have been organized in communal farms).

The situation of small farmers in the district of Tonosi is very similar (farm size distribution, production patterns) with the four project areas in Los Santos and Veraguas provinces. Data from a 1977 census of 1685 farms in the Tonosi District revealed that for the 701 farms below 10 hectares, 84 percent of the operators were occupied primarily in agriculture and 75 percent dedicate most of their time to working their own farm. They produced primarily rice, corn and beans on, respectively, 78, 79 and 41 percent of these farms. Even fewer farms cultivated cassava, yams, and sugar cane. Very few farms produced vegetables of any kind. Eighty-two percent of the small farms had chickens, 38 percent had pigs and 11 percent had cattle, averaging respectively 28, 4, and 10 head per farm. The gross volume of production on farms under 10 hectares yielded an estimated net farm income of $390 per farm. Off-farm sales however were much less; 60 percent of these farms had no crop sales and 37 percent had sales of less than $200. Approximately 50 percent of these farms sold livestock products and the average annual sale was $225 per farm. Labor employed on small farms during months of peak demand, averaged 20 person-days per farm from a monthly labor availability of 34 days per

farm. Forty percent of the small farm families obtained on average 14 days of off-farm work, generally for cash wages. Total family income (net farm income plus off-farm wages) for subsistence farmers was estimated to be $755 (in 1978 prices) or $161 per capita.

Since recent census data is not available for the other project areas, the situation of small farmers must be inferred from 1971 census data which does not provide detail on production by farm size category. However, recent field observation confirms that the present status of these farms has not changed appreciably from the low average crop production per farm evident in the census year. At that time, between 25 and 75 percent of farmers cultivating rice and corn in each project area had devoted less than 1.5 hectares to both crops combined.

2. Farmer-Ranchers.

There are an estimated 7,000 units in the project areas. This number is estimated, however, because the census date do not provide sufficient information to cross-tabulate production with farm size at the district level. Nevertheless, in every area there are substantial numbers of small ranching units. In some of the areas, particularly those in Veraguas province and the Gualaca district in Chiriqui there are more units between 10 and 100 hectares than units under 10 hectares. A very large percentage of the former units are mixed ranching/cropping activities with extremely low productivity and profitability.

Data from an IDIAP survey show that the median farmer-rancher in Santiago has an average 4 to 5 family members and 32 person months of available farm labor of which 24 are utilized. The farm encompasses 34 hectares; 3.5 hectares are devoted to crops and 23 hectares to cattle. The annual net family income derived principally from production of livestock, corn and rice plus off-farm wages is estimated $1663 or $363 per capita.

The farmer-rancher in the Tonosi District operates between 10 and 20 hectares of land and 90% of these operators are occupied primarily in agriculture. They produce primarily rice, corn and beans on respectively 84, 85 and 45 percent of these farms. Chickens, pigs and cattle are raised by 90, 53 and 53 percent of the farmer-ranchers, while the average inventory of these livestock respectively was 23, 4 and 14 head per farm. The total volume of production on these farms yields an estimated net farm income of $900 in 1978 prices. One-half the farms realized no crop sales, and most farms with sales earned under $200. Two-thirds of the farmer-ranchers sold some livestock products for an average annual sale of

$457 per farm. Thirty percent of these producers worked off-farm and earned an estimated $250 in wages. The total estimated family income (farm income plus wages) was $1,150 per farm or $245 per capita in 1978 prices.

Recent survey data obtained from a random 20% sample of farms in Caisan, Renacimiento, the most progressive of the project areas, indicate that there are few small subsistence farms in the area. Agricultural production among the farmer-ranchers was as follows:

Ninety percent of the farms cultivate corn and bears while 33 percent cultivate rice; the average area dedicated to these products was 5.9, 6.7 and 1.4 hectares respectively; 59, 79 and 22 percent of the production respectively was sold by 75, 86 and 9 percent of the farms cultivating the products. Sales averaged $776, $2,250 and $288 per farm for corn, beans and rice respectively. Very few farms cultivate other products. Between 2 and 5 percent of the farms produced cabbage, bell peppers, tomatoes, sugar cane and tobaco, all of which were cultivated, on average, in plots of less than .6 hectare; 14% produce plantains and 42% cultivate coffee. Chickens, pigs and cattle were raised by respectively 92, 78 and 49 percent of the surveyed farms, and the average inventory was 36,6 and 44 head respectively. The estimated average net income (gross sales minus cash expenses) for all surveyed farms was $3,050. Considering that 37% of the surveyed farms were under 10 hectares and 57% were under 20 hectares, it would be reasonable to assume that incomes on these farms would be substantially below the overall average.

3. Group Farmers.

There are approximately 60 asentamientos (group farms) in the project area with a total of 1,800 members. A 1977 survey of 20 asentamientos in the Sona district of Veraguas indicates that the asentado continue earning low incomes and remain underemployed as was the case in subsistence agriculture, although they generally preceive their condition to be improved. The surveyed asentamientos produced primarily rice, while corn and cassava are cultivated on a smaller scale. They also raise beef and dairy cattle, and chickens. Approximately 60 percent of gross receipts were derived from annual crops and 40 percent from livestock products. The asentados on average did not earn a profit from agricultural operations in 1977, a bad crop year. They earned approximately $250 per family in cash wages paid in accordance with the hours worked on the asentamiento. Also they derived income in kind from commodities produced on the

group farm and from private garden plots. The market value of the products received from these latter two sources was perhaps $300, giving a total family income of around $550.

The reported level of underemployment of the surveyed asentamientos was approximately 50%. The asentado declared they were available for work on group projects during 4 days of the week while they reported working an average 2 days per week. The other one or two days a week were devoted to their subsistence plot. Employment on neighboring private farms was not significant.

A sample of the surveyed asentados was asked if their living standard had improved as a result of joining an asentamiento. Virtually all believe their economic situation is improved, while most declared that employment and access to social services had improved. It is also to be expected that their nutritional status has improved as access to livestock products undoubtedly increased from what previous subsistence farming would have allowed.

C. Socio-Cultural Characteristics of the Target Population.

Detailed data on socio-cultural characteristics is not yet available for all areas in which research activities will take place. However, the socio-cultural characteristics for the Panamanian campesinos are relatively similar in most parts of Panama. Data which are available for the Renacimiento District of Chiriqui Province and for Los Santos Province demonstrate the relative homogenity of many rural Panamanian socio-cultural characteristics. To be sure regional differences do appear, e.g. attitudes toward credit and tendencies toward migration. Those differences will be noted and evaluated during the dignostic studies which will be carried out for each area.

The small farmers of the Renacimiento (Caisan) region live in dispersed, nucleated settlements (hamlets) that may contain between 10 and 60 dwellings. These hamlets usually have a primary school. These schools have been constructed both by residents of the hamlet itself, and by inhabitants of the surrounding areas.

The basic social unit of the farmers is the nuclear household, although extended family households are also present. The household consists of a conjugal pair and their children, occasionally augmented by the presence of grandparents or siblings. Individual households are linked through consanguineal and/or affiliate ties. Since migration into and out of this area is minimal, communities are unified by a very strong kinship network.

The household is also the basic economic unit. The division of labor follows sex and age lines: men engage in field activities; women take full charge of domestic chores, keep chickens, and tend the pigs if the family has any. Children, depending on their sex and age, may assist their parents in routine field and household tasks. The typical dwelling unit is a thatched-roof, wood floor structure with two to three rooms. In almost all cases, the house is too small for the number of persons occupying it. Within the house are found such items as hand-made beds and hammocks. The majority of homes lack utilities.

The median size of farms including ranches, in the Caisan area is 20 hectares. (56% of all farms have 20 hectares or less however, not all land is under cultivation.) Although a slash and burn technology is still used, many farmers are beginning to employ modern agricultural techniques. Field investigation revealed that tractors were used extensively for plowing the land. Often the farmers in any one area organize themselves into what may be termed a "pre-cooperative", and then formally petition the Ministry of Agriculture (MIDA) for a tractor. MIDA then sends a tractor and driver to plow the land, and the farmers pay an hourly fee (about $16.00) for this service.

Two or three principal crops are grown on any one farm, while a large number of minor crops are cultivated throughout the Caisan region. The principal cash crops are coffee, corn, beans, potatoes, tomatoes, onions, sorghum, tobacco, and mangoes. During the dry season from December through April, some off-farm wages are earned on coffee and vegetable farms. In addition to subsistence cultivation, some animals are kept for domestic consumption. Field investigation revealed that most farmers are technically squatters on land, for they do not possess title to the land they occupy.

Small farmers are linked by several other mechanisms in addition to the kinship network. The most salient of these is the voluntary association known as the junta, of which there are two types: the junta local and the junta comunal. Respected individuals from the various geographic subdivisions of the corregimiento are the de facto leaders of the juntas locales. The difference between the two juntas is in size and scope. As the name implies, the junta local limits itself to localized public concerns and its membership consists of those residents of the area concerned; the junta comunal encompasses a broader area, and focuses on problems affecting the entire corregimiento.

In addition to these two organizations which operate as the basic units of government throughout the country, two other formal organizations exist: the Comité de Salud and the Padres de Familia. The

Padres de Familia is equivalent to the North American Parents-Teachers Association, and addresses itself to similar concerns. Men and women members of the Padres de Familia meet regularly to plan policy, organize fund raising programs, and to engage in self-help construction programs for the school. The most common mechanism they use for raising funds are fairs and raffles. The Padres de Familia contribute both funds and in-kind help in the construction of schools, and later, to help meet the operating costs of the school. For example, local agricultural produce might be contributed to the school feeding program.

The Comité de Salud is a prerequisite from MOH funded health programs, such as aqueducts, latrines, community gardens, and health posts. The community must form a Comité de Salud and guarantee local participation in these health programs before the MOH approves any project. In the construction of aqueducts for example, the Comité de Salud helps in the installation of pipe, and later oversees the maintenance of the public facility. Another function of the Comité de Salud is to heighten community consciousness of the determinants of community health, and to stimulate local involvement in other improvements resulting in a higher standard of health.

One additional organization characteristic of the region is the cooperative. Through cooperatives, farmers organize themselves and petition MIDA to plow their land; their contract trucks to take produce to market; and they request loans from the Banco de Desarrollo Agropecuario. Often these services are available to them only when they organize themselves into a cooperative organization.

Small farmers of the Los Santos Province (Azuero) share many of the characteristics of the campesinos in Renacimiento. They live in dispersed, nucleated hamlets containing between 5 and 50 families. Roads are absent but horse trails connecting hamlets are sometimes transited by vehicles in dry season. These hamlets often have a primary school constructed by residents of the hamlet and inhabitants of the surrounding area. Generally there is no other community infrastructure such as potable water or electricity.

The basic social unit of the farm household is the nuclear family, consisting of a conyugal pair and their children although it occassionally includes grandparents or siblings. Their normally two-room dwelling has a thatched-roof, a dirt floor and walls made of straw and sticks. Water is generally obtained from a superficial source; latrines customarily are not used. The household is also the basic economic unit, with family members providing virtually all farm labor. The usual division of labor has men engaged in field activities and women tending all domestic chores.

Within the Azuero region there is an historical tradition of cooperative labor patterns. Associative agricultural work groups and the exchange of labor for labor (trueque) are traditional institutions, although these arrangements are gradually being replaced by salaried labor. The two forms of exchange labor that have contributed a great deal to the configuration of local society are the junta and the peonada.

The junta is perhaps the more widespread and better known of the two patterns. When a peasant has a particular task to accomplish within a very limited amount of time, usually one day, he invites kinsmen, friends, and "compadres" to help him. Assistance is strictly voluntary and no one is morally required to accept an invitation to a junta. Although one extends an invitation this does not mean he is in turn obligated to attend a junta called at a subsequent date by one of his guests. The only social obligation incurred by someone who calls a junta is to provide food and drinks, usually fermented ones in sufficient quantity. The number of volunteers who gather at a man's calling depends on his prestige or status within the community. It could be said that the junta is an excellent barometer of someone's standing in the social stratification system. The higher one's prestige, the more people will attend. A significant degree of his standing is determined by his largesse in providing food and drink.

The peonada is the second labor sharing institution observed which, despite present social changes, is still widespread among the peasantry. Unlike the junta, where everybody is invited to come and help a neighbor, the peonada is amore selective affair, for only skilled men are asked to participate. The host has to provide food and drink, but he acquires a stronger contractual obligation to return, within the same agricultural year, the amount of labor he has received from his friends. A peonada might also involve several days work; usually heavy agricultural activities like jungle clearing with axes (tumba de monte).

Because it is selective and involves men of productive age, this institution is widely used in the Azuero region today by peasants belonging to different social strata with the exception of the very large cattle breeders. Besides clearing jungle, it is widely used for critical agricultural jobs like planting, weeding and harvesting. However, in ranching activities, it is only employed for clearing weeds from pastures with machetes. The peonada like the junta is beginning to desintegrate as a social custom. Wealthier farmers are increasingly repaying whatever labor they owe by hiring men to do the job for them.

In addition to the formalized labor relationships described above, there currently exist in the Azuero region a multiplicity of organizations which may be deemed cooperative or associative. This tradition is of significance to the project, for it indicates that there are precedents for the type of organizational patterns that will be utilized by the project. A partial listing of these associative groups includes: agricultural cooperatives, savings and credit cooperatives, juntas comunales, juntas agrarias and asentamientos. A distinguishing feature of these organizations is the objective of the activities they undertake. Their activities may be "communal" in that their objective is to improve the services or environmental sanitation, potable water, etc., or their activities would be functional in character, involving some specific aspect of production such as agricultural credit, irrigation, veterinary services, commercialization of production, etc.

In short, patterns of associative labor do currently exist in Los Santos, and throughout the Azuero region. They are practiced by the social target groups of the project, and though they are on the decline, it may be possible to build on these traditional patterns.

Group Farmers

Asentamientos are concentrated in principally two of the project areas; around 15 are located in Baru, Chiriqui Province and encompass 500 asentados (families), and about 45 are located in the four areas of Veraguas Province and encompass 1300 families. The social organization of the asentados is radically different from that of other campesinos. The asentados are group farmers, living in nucleated settlements, practicing modern agricultural techniques. They receive direct technical assistance from the Ministry of Agriculture (MIDA) and financial assistance through the Agricultural Development Bank (BDA).

At first the asentados appear to lead a more comfortable existence than other campesinos. In some instances they are provided government constructed homes made of cement blocks; the houses may have a potable water connection but lack toilets and electricity. However, in other respects such as level of income and material possessions their situation is virtually the same as other campesinos.

The primary agricultural activity of the asentados throughout the country is the cultivation of rice as a cash crop; to a lesser degree they produce corn and raise livestock. The associates report daily the number of hours worked on communal projects. When the products

are sold, each member receives payment according to the labor he contributed. A deduction from gross revenues is made for repayment of loans, however, these often are in arrears since wages take precedence. Many asentados have small gardens to provide a minimal but relatively secure source of food for domestic consumption. The gardens generally are located adjacent to asentamientos on marginal or hillside land since such subsistence-type production on communal land has been officially discouraged.

As is the case with the vast majority of peasants, the asentados do not have title to the land they occupy. Through their national representative they have brought this subject to the attention of government authorities, but the issue has not been resolved. Disagreements appear to exist, even among the asentados, as to the type of title desired; some prefer a corporate title while others prefer individual titles.

The management of asentamientos is carried out by a committee elected by all associates. During weekly meetings, the associates participate in a discussion of the operation and future plans of the farm. In this forum, associates voice their concerns and measures for dealing with them are developed by the community. Representatives of the Ministry of Agriculture or the Agricultural Development Bank participate in the weekly meeting and work closely with the management committee.

Additional organizations functioning within asentamientos are the Junta Local, the Junta Comunal, the Comité de Salud and the Padres de Familia, which operate in the same manner as described above.

D. Social Issues for Project Feasibility.

There are several potential social constraints on the feasibility and implementation of the project, including: a communication gap or social/cultural dissonance between researches and farmers, and low level of sophistication among target farmers, and tenure considerations.

1. Farm-Research Communication.

The project will require a continuous interchange of ideas between farmer and researcher throughout the stage of selection of research, and testing, validation and dissemination of results. Among the major barriers in the process might be: an inability to establish effective communication between researcher/exchange agent

and target group members because of mutual distrust language differences or differing value systems, and a reluctance by target group to accept new ideas or to modify tradition. It is expected, however, that the research methodology to be utilized will involve the researcher and farmer as a team to address the problems confronting them. By allowing the voluntary association of the two parties, a more equitable relationship may be established. This may greatly reduce potential barrier to communication as well as enhance the understanding of personal values. Also, special training of researchers to sensitize them to campesino value systems will be undertaken during project implementation.

The issue of socio/cultural dissonance appears, however, to be less of a problem than expected. To date IDIAP-CATIE field experience has been very positive with regard to the willingness of farmers to associate with a research activity. There are many instances when requests for assistance with agronomic problems have been unattended for lack of personnel. Where IDIAP has had personnel in the target areas as, for example, the Cerro Punta area, and more resently the Caisan area, participant response has been excellent. In the former area IDIAP personnel have been working closely with more than two hundred members of potato cooperatives for more than two years. Also experience with asentamientos indicates that the associates maintain a reasonable level of participation in the production planning and decision making process, and maintain regular contact with government technical advisors whose services are given an overall satisfactory rating.

A corollary to enhanced communication is the employment of appropriate means of communication to achieve desired spread effects. The applied on-farm research methodology was designed to make "action" the principal means of communication, while mass communication-radio, printed bulletins and demonstrations - will be secondary but important tools. Another effective means of communication to be utilized will be provided by group action. The peonada and junta systems of work interchange, as well as cooperatives and asentamientos, will facilitate the dissemination of research through existing social structures.

Specific steps taken to assure successful diffusion of the technologies developed under the Project within the eight target areas will include:

a. Developing and validating the technologies on farm. This will permit continued surveilance of the effects of the socio-cultural mileau on farmer acceptance of the technologies being developed and revisions, as necessary, of the technologies to make them more ac-

ceptable to the farmers. As mentioned in the Detailed Project Description, all IDIAP multi-disciplinary teams, both during the research and validation phases will have a rural sociologist/anthropologist on staff.

b. Deliberately selecting as participants during the validation phase one or more farmers in each Project area who are known leaders and who have the reputation of being innovators. Interest on the part of the community at large in adopting these technologies should increase as neighbors witness the successful results of the technologies as applied by individuals they know and respect.

c. Incorporating local BDA and MIDA extension agents on a rotating basis in both research and validation activities. As these agents become acquainted with these activities and their potential benefits to farmers, assuming these technologies are successful, they can be expected to alert other farmers in the Project areas to their existence and encourage them to also adopt them.

d. Maintaining close contact throughout all stages of Project implementation with local community groups. The diagnostic studies described in the Detailed Project Description will assist in detecting local groups (e.g. cooperatives, asentamientos, juntas comunales, clubes de padres de familia, comites de salud, etc.) that have community support.

2. Sophistication Level of Recipients and Acceptance of Technology.

Although potential recipients in the project's target group are generally depicted as tradition bound producers, there is ample evidence that some modern production methods are utilized by some small farmers in all project areas and they have at least an overall familiarity with modern production inputs. In particular, farmers associated with asentamientos are using machinery, improved seeds, farm chemicals and credit for virtually all commodities produced. It was also found that between 40 and 60 percent of the independent producers surveyed in Caisan, Renacimiento, reported using chemical products and improved seeds for their crops, while 30 percent used chemicals or feed for livestock. Also, on small farms in the Tonosi district almost 20 percent of the producers utilized herbicides and few even hired machinery for soil preparation.

While it is clearly not the intention of this project to introduce preconceived technological packages involving routine use of chemicals and machinery, it can be anticipated that these practices will accompany the research program and that farmers will probably adopt them as their advantages are demonstrated. The prin-

cipal agronomic problems that farmers reported in the Caisan area were weeds, insects and disease, all of which may be managed by mechanical, chemical or biological means. Hence there appears to be the possibility of choosing among alternative controls and still adapt to prevailing cultural and personal preferences. Moreover, the approach to be used by the project is to treat the human constraint as another site-specific factor to be addressed by applied research.

Another potentially serious barrier to technology adoption is the educational level of recipients. Approximately one-third of the recipients-regardless of type of producer or area of the country-have less than a third grade education, which casts doubt on their funcional literacy. Consequently, the technology to be introduced must be communicated by method understandable to the recipient. One such means is through children who are attending vocational agriculture schools. Panama is continuing to expand the basic education program which in the rural areas emphasizes teching agricultural skills. It is believed that children's experiences with modern practices will be an important factor influencing farmers attitutdes toward new technology adoption. Project researchers will be expected to use school parcels to demonstrate new practices and to involve parents in their application. This will allow farmers to evaluate new technology under minimum risk while providing researchers with a forum for presenting new ideas at an elementary level of sophistication.

3. Risk Management Behavior.

Risk management is a multi-variate concept and as utilized here will refer to acceptance of the technology itself and the means through which it may be applied e.g. agricultural credit. As has been explained in the research strategy section, the technology to be introduced will conform to the norms established by participants. Moreover, on-farm research will initially involve a minor percentage (10%-20%) on the farmer's land production. Depending on the types of practices to be modified, e.g. plant spacing, intercropping and greater use of chemical imputs, the level of risk will vary. To alleviate this risk IDIAP will provide the minor quantities of inputs that may be required for the field trials on the farms participating at the technology generation and validation stage. Nevertheless, recommended modifications involving greater expenditures on inputs and hence use of credit would appear to pose the greatest risk from the recipient point of view. Hence, recipient attitudes toward credit may be a constraint to adoption of some modern practices.

Among farmers in the Renacimiento Area, the use of credit is apparently well established. Fifty-five percent of surveyed farms

reported using credit although on small farms the average loan was under $1,000. By contrast in the Tonosi area, generally known for conservative traditions, only 10 percent of the farmers used credit from official sources in 1977, and of these virtually all were medium or large farms. Therefore, it would appear that modification of agricultural practices among more traditional farmers will have to give greater attention to the apparent aversion to credit and must modify the agronomic recommendations accordingly. The time-phasing of proposed modifications should also reflect the concern for averting risk, i.e. changes expected to involve less risk should be proposed first.

In contrast to marginal farmers, use of credit among members of asentamientos appears to be a well accepted practice. The annual credit requirement must be approved by the membership upon the recommendation of a credit committee. It is known that all asentamientos consistently employ credit for both production and investment needs. As explained in the strategy and technical feasibility sections, the additional requirements for credit as a result of participating in applied research will be modest at the outset and could decline in instances when more efficient (appropriate) technologies are adopted.

A related and perhaps equally important aspect of risk management is the expected payoff or profitability of the "experiment".

A review of empirical findings leads to the conclusion that the overriding consideration conditioning the rate of adoption is the on-farm profitability of agronomic recommendations. Thus we see that despite the availability of inputs, credit, markets, etc., if the farmer does not think a new practive is profitable, he will not adopt it.

A recent analysis of CIMMYT adoption studies concluded:

> "The impression from these studies is that the most pervasive explanation of why some farmers do not adopt new varieties and fertilizer while others do is that the expected increase in yield for some farmers is small or nil, while for others it is significant due to differences (sometime subtle) in soils, climate, water availability, or other biological factors."

One can conclude that even when there is a workable agricultural infrastructure, available inputs and credit, site-specific

factors affecting profitability still exist and are s[illegible]ough to significantly affect adoption or non-adoption. The are[illegible]es of the research effort combined with a research/validation p[illegible] in which profitability is a paramount consideration will enhan[illegible] the likelihood of high rates of adoption.

4. Tenure Consideration.

Finally, there is a question of varying rates of acceptan[illegible] of new technologies depending on the tenure status of the small farmer. Although some argicultural land is rented in at least some of the project areas, the major portion of the land held by small farmers and farmer/ranchers is either held under rights of usufruct (derechos posesorios) or titled. There is also a tradition of share-cropping between small farmers and large landholders, especially in the Azuero Peninsula. Tenure considerations may be an important factor in the acceptance of new technologies if in the case of rented (or share-cropped) land, the landlord might appropriate the major portion of the benefits. However, in Panama the proportion of producers who rent (or share-crop) is quite small, roughly one in ten. Where land rental does occur, the renter often also owns or has rights to other land as well. Hence, the producer generally will be able to avoid sharing increased income with large landholders.

Land held by usufruct, which constitutes the major form of tenure in Panama, both in acreage and in number of units, may, for most purposes be considered as the equivalent of a private title. Derechos posesorios, which are established by the person who first clears and cultivates land in the public domain, are recognized by the Panamanian legal system. These rights are transferable and are sold at the same price per hectare for which titled land would be sold. Also usufractuary rights are recognized by the official agricultural bank (BDA) and are sufficient for purposes of obtaining credit up to $5,000.

In the case of asentamientos legal title to the land remains with the government, although title may eventually be transferred to the asentamiento members. However, usufruct is assured for asentamiento members under existing arrangements. It would appear that problems related to tenure considerations will be minimal.

INITIAL ENVIRONMENTAL EXAMINATION

Project Location: Panama, R. P.

Project Title: Agricultural Technology Development

Funding: FY 1979 - $ 6.0 million loan
$ 1.0 million grant

Life of the Project: Five Years

IEE Prepared by: Jane Stanley Date: May 14, 1979

Environmental Action Recommended:

This IEE has determined that no significant adverse environmental impacts will result from the project's activities. Therefore, the Mission recommends that the project's activities be given a Negative Determination.

Concurrence: _____ Date: 7/12/79

Warren E. Lane
Acting Mission Director

INITIAL ENVIRONMENTAL EXAMINATION
AGRICULTURAL TECHNOLOGY DEVELOPMENT

I. BACKGROUND

The Agricultural sector plays an important role in Panama's economy. In the middle 1970's agricultural production in Panama accounts for almost one-fifth of the gross national product, employs about 30% of the labor force and generates nearly one-half of the country's merchandise exports. Yet, beginning in the late 1960's the growth rate of both export crops and crops for domestic consumption declined. While the decline in export crops has been largely due to political reasons, the decline in crops for domestic use has been caused by a combination of factors, including political and economic uncertainties, droughts, neglect of private producers by the Ministry of Agriculture services and, perhaps most importantly, the growing scarcity of readily accessible good agricultural land. Panama has very little flat land with soils suitable for agricultural production. Overall it is estimated that only one-fourth of the country's total land area is suitable for crops and that only one-half of this area is unquestionably suited for mechanized field crops. Most of this land is located on the Pacific slopes in the three provinces of Chiriquí, Veraguas and Coclé. However, in recent years the subsistence needs of the country's growing rural population has led to the indiscriminate cutting of primary forest lands on steep slopes - land which is not suitable for agricultural production.

Today, on the country's Pacific slopes, a band of land of approximately 12,000 square kilometers or 16% of the country's total land area is in a state of erosion, ranging from serious to irreversible, due to this indiscriminate agricultural expansion. Little effort has been made to stop this expansion of agriculture onto unsuitable lands and to increase productivity in areas where agriculture pursuits are feasible and non-damaging to the country's natural resource base.

The FY 1981 CDSS for Panama identified 89% of Panama's rural population as living in poverty conditions, with an average per capita income of $304. According to various surveys, most rural poor are engaged in subsistence, often of the slash and burn type, agriculture on small plots. They have no legal title to the land they work, receive no institutional credit and utilize rudimentary production methods. In 1971 there were about 94,000 families on farms in Panama, and 43,500 of these families occupied farms less than 5 hectares in size and cultivated a total of only 53,900 hectares of annual and perennial crops, primarily rice, corn, beans, tubers, bananas, plantains and various garden vegetables. Among these small farms, livestock holdings were few. Only 18% of the 46,750 farms below 10 ha. in size had cattle. Most of these small farms realized little or no farm sales in 1971 since most produce was used for household consump-

tion. Of the 43,500 farms under 5 hectares, 25,000 m · · no sales in 1970/71 and 18,000 had sales of less than $500.

II. THE PROJECT AREA

Priority areas for the Agricultural Technology Development Project were selected on the basis of six factors which indicated that they contained the highest concentration of small marginal farmers and organized farming groups and had a good potential for increased production and other farm improvements. All but one of the priority areas were located in the two provinces of Veraguas and Chiriquí, Panama's two most important agricultural regions. These areas are:

1. Renacimiento District, Chiriquí Province.
2. Barú District, Chiriquí Province.
3. Bugaba District, Chiriquí Province.
4. Gualaca District, Chiriquí Province.
5. Soná District, Veraguas Province.
6. Montijo District, Veraguas Province.
7. Parts of the Santiago, San Francisco, La Mesa and Cañazas Districts, Veraguas Province.
8. Los Santos District, Los Santos Province.

Average farm sizes in these areas ranges from 10-20 has., with a significant amount of farms less than 10 has. in size. Both crop and livestock production in these areas is generally low. Many areas, although they contain good agricultural soils, are highly susceptible to erosion. In other areas soils are poor and need several agricultural inputs to raise their productivity level.

III. PROJECT DESCRIPTION

The goals of the Agricultural Technology Development Project range from increasing the standard of living of Panama's rural farmers to increasing Panama's entire agricultural sector income and generating new employment opportunities. These goals are to be achieved principally through increasing the capacity of the government's Agricultural Research Institute (IDIAP) to carry out adaptive research and through strengthening the Government of Panama's capabilities to transmit appropriate agricultural technologies of the small farmer.

The Project consists of two major components:

A. Institution Building, and

B. Research and Dissemination of Validated Technology.

A. Institution Building

The institution building component will consist of: (a) staff development through staff training and improvement, selection of new staff and internal reorganization for the more effective utilization of each staff member, (b) technical assistance from both short and long term consultants, (c) construction and upgrading of physical plant facilities, and (d) the provision of equipment and materials to complement IDIAP's research, technology transfer and service programs.

B. Research and Dissemination of Validated Technology

The project's research activity is one of applied research. It will emphasize the adaption to Panama's conditions of agricultural production technologies that have already been generated in other parts of the world, rather than the creation of new knowledge. In the 8 priority project areas a team of agricultural scientists will define, test, and evaluate technologies. Tests will be performed on three basic levels. Some technicians will conduct highly controlled trials on experimental stations. However, most technicians will conduct on-farm trials. The most promising technologies will then be submitted to agro-economic validation trials by the participating farmers in the area. In the validation trials the farmer will pay for inputs and furnish labor. The technicians will provide technical assistance and supervision and obtain information from these farmer trials, but the farmers will do the evaluation. The following year IDIAP technicians will make follow-up surveys to determine whether the farmers have adopted new technologies, to what degree and, if not, why.

Research activities will be concentrated in areas having potentially high pay-offs in increasing small farm productivity: Modular beef/milk production systems; cropping systems; and mixed farming/ranching systems.

Research on modular beef/milk production systems will be designed to solve the production constraints of small and medium beef/milk producers. It will most likely include experimentation on improved grasses, such as stoloniferous grasses, which decrease erosion and have a higher protein content, as well as on other improved farm management techniques such as the application of

methods for disease control, better feeding practices and improved pasture rotation practices.

Research on cropping systems will basically consist of crop varietal testing in conjunction with the introduction of more efficient natural resource management (such as better soil management practices) and better pest and weed control methods. Most research will be carried out in areas where one or two commodities prevail, and may be conducted on up to ten crops in total.

Research on mixed farming systems for low income farmers will be designed to assist marginal and subsistence farmers. It will emphasize mixed cropping and small animal production to better utilize the farmers' land and labor. Activities tested will be generally labor-intensive and require little investment.

Priority commodities selected from initial impact projects will include rice, corn, edible legumes, sorghum, potatoes, tomatoes, onions, yucca, beef, pork, milk, poultry and eggs.

IDIAP and MIDA will work to create a system of information and technology transfer to take advantage of technological advances to the field. They will cooperate with other public and private organizations in the agricultural sector. IDIAP and MIDA have formulated a plan for technology dissemination which calls for two MIDA production agents to be assigned technology transfer responsibilities on a full time basis in each area. In addition, field staff from MIDA and other organizations will work under IDIAP direction for three or four months per year for a two year period in the project areas in an "on-the-job" training situation. Research results will, thus, be disseminated to all cooperating agencies with linkages into IDIAP work through their cooperating staff. These activities will be completed by training programs for small farmers that will include short courses, field days, seminars, workshops, demonstrations, publications and mass media campaigns.

IDIAP will set up a Technical Communication Section that will be responsible for all information activities. It will develop appropiate field communication methods, communications training programs, produce printed, audio and visual materials, and coordinate communications with other GOP and international agencies.

In addition, IDIAP's Documentation Section will be improved so that it will be able to provide greater access to needed information. This Section will work closely with international agencies, attending documentation short courses and coordinating indexing systems for cross-reference.

IV. ANALYSIS OF ENVIRONMENTAL IMPACTS

This section of the IEE sets forth the reasonably forseeable effects that the proposed Agricultural Technological Development Project will have on Panama's physical and human environment. Areas of impact considered include impacts on land and water resources, wildlife, and cultural and socio-economic conditions.

Most of the project's institution building and technology development activities will create no direct environmental impacts. Only the construction activities proposed under the project's institution building component have a potential for creating negative impacts. However, all sites and plans for new facilities will be reviewed by AID engineers to ensure significant environmental damage is avoided. Negative impacts on air and water quality during the actual construction of facilities may be unavoidable, however, they will be short-lived and minor because construction activities will be widely dispersed, and the buildings will be small in size.

The project's proposed research activities should have many positive impacts on Panama's natural resource base.

Many of the proposed research activities are directed towards the low income subsistence farmer, some of whom practice slash and burn agriculture. Adoption of new technologies by these farmers should reduce their need to continue slash and burn activities and, thus, prevent deforestation, loss of wildlife habitat, and severe erosion of lands unsuitable for agricultural pursuits. Prevention of erosion will, in turn, have positive impacts on the quality of water resources and the aquatic life they support. The replacement of Faragua grass with stoliniferous grasses on pastures and the adoption of better pasture rotation practices, under the proposed research on modular beef/milk production systems, as well as the adoption of better soil management practices under crop research activities, will also reduce erosion, maintain soil fertility, and prevent sedimentation of water resources and detrimental effects on aquatic life.

The project should also have positive impacts on Panama's human environment. In terms of cultural effects, farmers may at first show some resistance to the adoption of new agricultural technologies. However, once these technologies are proven to be economically beneficial, they should be readily accepted. Impacts on the socio-economic condition of small farmers should be quite beneficial as all research activities are oriented towards improving farm productivity, farm income and employment opportunities. Small farm families should also benefit in terms of their nutritional status. Increased farm productivity and the introduction of small animal production will make more and higher quality food available for on-farm consumption.

The project's proposed research on better pest and weed control methods does have a potential for producing some adverse effects on

both natural and human environment. This is expected to be minimal because IDIAP is the agency which controls pesticides registration in Panama, and it is one of its registration requirements that all pesticides manufacturers provide labeling containing toxicological and environmental data as well as EPA's established tolerance levels for pesticides applied to crops used for human and animal consumption. Also, IDIAP will be promoting an integrated pest management which should lead to safer utilization of pesticides by Panamanian farmers.

AID Environmental Procedures require that all IEE's for projects that include assistance for procurement or use, or both, of pesticides "shall include a separate section evaluating the economic, social and environmental risks and benefits of the planned pesticides use to determine whether the use may result in significant environmental impact". Exempt from these procedures are "projects including assistance for procurement or use, or both, of pesticides for research or limited field evaluation purposes by or under the supervision of project personnel. In such instances, however, AID will ensure that the manufacturers of the pesticides provide toxicological and environmental data to safeguard the health of research personnel and the quality of the local environment in which the pesticides will be used. Furthermore, treated crops will not be used for human or animal consumption unless appropriate tolerances have been established by EPA or recommended by FAO/WHO, and the rates and frequency of application, together with prescribed preharvest intervals, do not result in residues exceeding such tolerances". IDIAP has made a commitment to follow established EDA guidelines for pesticide use.

The pesticides proposed for use in this project have been reviewed by a qualified plant protection specialist. Since some of the pesticides are under rebuttable presumption against reregistration by EPA, an assessment of the proposed pesticides has been prepared by the specialist and is incorporated herein by reference.

Certain other pesticides which are likely to be cancelled by EPA in the immediate future have been included for comparative purposes in limited field trials and adequate conditions have been attached to the proposed uses including, in some instances, destruction of crop residues.

Hence, the pesticide assessment concludes that the benefits of the proposed uses, as revised, significantly outweigh the risk and that there are no reasonably foreseeable significant adverse environmental impacts.

Pesticides used in this project both under highly controlled conditions on experiment stations and closely supervised field evaluations do not need further environmental review. However, pesticides will be used in the project's agro-economic trials and will be applied by the farmers themselves at the validation stage. These applications will occur on a relatively small land surface and will be utilized by a small number of farmers. Not more than 20 to 30 farmers in an area (maximum) would be involved. The experimental areas will range between 500 and 800 square meters. Thus a small number of farmers and a very small land surface will be involved in pesticide utilization. Area field team members, who will receive training in proper pesticide utilization techniques, will be able to provide sufficient supervision of participating farmers so that pesticide use under the project will not constitute an environmental hazard. More importantly, IDIAP's Integrated Pest Management Program will serve as the mechanism to achieve safer and more effective utilization of pesticides by all target group farmers.

V. SUMMARY AND RECOMMENDATIONS

The project's institution building activities will produce little or no environmental impacts. Most of the project's research /dissemination activities should produce highly positive impacts on Panama's natural and human environment since they will reduce deforestation, erosion and sedimentation of water resources and improve socio-economic conditions for the rural farmer. No significant adverse environmental effects have been identified.

The Mission, therefore, recommends that the project's be given a Negative Dermination.

TIME PHASED IMPLEMENTATION PLAN

TYPE OF ACTIONS

A. LOAN AGREEMENT

B. PROCUREMENT OF EQUIPMENT

C. PROCUREMENT OF TECHNICAL SERVICES

D. TRAINING

E. CONSTRUCTION

F. RESEARCH

TIME PHASED IMPLEMENTATION PLAN

(A) LOAN AGREEMENT

ITEM	ACTION	ACTION AGENT	DATE
A1	Loan Authorization	AID/W	7/79
A2	Negotiation and Signature of Loan Agreement	AID/Panama IDIAP-GOP	8/79
A3	Completion of Initial Conditions Precedent	IDIAP-GOP	11/79
A4	Established Drawdown and Accounting Procedures	IDIAP-AID/P	10/79
A5	Completion of Conditions Precedent to Area Field Research	IDIAP-MIDA	5/80
A6	Initiate First Annual Evaluation	IDIAP-MIDA-AID/P	7/80
A7	Complete First Annual Evaluation	IDIAP-MIDA-AID/P	9/80
A8	First Annual Loan Review	IDIAP-AID/P	11/80
A9	Initiate Second Annual Evaluation	IDIAP-MIDA-AID/P	7/81
A10	Complete Second Annual Evaluation	IDIAP-MIDA-AID/P	9/81
A11	Second Annual Loan Review	IDIAP-AID/P	11/81
A12	Initiate Third Annual Evaluation	IDIAP-AID/P	7/82
A13	Complete Third Annual Evaluation	IDIAP-AID/P	9/82
A14	Third Annual Loan Review	IDIAP-AID/P	11/82
A15	Initiate Fourth Annual Evaluation	IDIAP-AID/P	7/83
A16	Complete Fourth Annual Evaluation	IDIAP-AID/P	9/83
A17	Fourth Annual Loan Review	IDIAP-AID/P	11/83

ITEM	ACTION	ACTION AGENT	DATE
A18	Initiate End of Project Evaluation	IDIAP-AID/P Contractor	7/84
A19	Complete End of Project Evaluation	IDIAP-AID/P	9/84
A20	Project Assistance Completion Date	IDIAP	9/84

(B) PROCUREMENT OF EQUIPMENT

ITEM	ACTION	ACTION AGENT	DATE
B1	Initiate preparation of specifications and bid documents for IFB No. 1 (key equipment and vehicles)	IDIAP	8/79
B2	Complete specs and bid documents for IFB No. 1	IDIAP	9/79
B3	Review specs and bid documents for IFB No. 1	AID/P	10/79
B4	IFB No. 1 advertised	IDIAP/AID/P	11/79
B5	Preliminary bid award for IFB No.1	GOP	1/80
B6	Definitive bid award/contract issued for IFB Bo. 1	IDIAP	2/80
B7	Equipment procured through IFB No. 1 in country	IDIAP	6/80
B8	Preparation of specs for IFB No. 2 (vehicles, field equipment, workshop equipment)	IDIAP	4/80
B9	Review specs and bid documents for IFB No. 2	AID/P	5/80
B10	IFB No. 2 advertised	IDIAP/AID/P	6/80
B11	Preliminary bid award for IFB No. 2	GOP	8/80

ITEM	ACTION	ACTION AGENT	DATE
B12	Definitive bid award/contract issued for IFB No. 2	IDIAP	9/80
B13	Equipment procured through IFB No. 2 in country	IDIAP	2/81
B14	Begin preparation of specs and bid documents for IFB No. 3 (laboratory equipment)	IDIAP	3/81
B15	Completion of specs for IFB No. 3	IDIAP	5/81
B16	Review specs and bid documents for IFB No. 3	AID/P	6/81
B17	IFB No. 3 advertised	IDIAP/AID/P	7/81
B18	Preliminary bid award for IFB No. 3	GOP	9/81
B19	Definitive bid award contract issued for IFB No. 3	IDIAP	10/81
B20	Equipment procured through IFB No. 3 in country	IDIAP	3/82
B21	Initiate preparation of specs and bid documents for IFB No. 4 (office equipment and furniture, vehicles)	IDIAP	4/82
B22	Completion of specs and bid documents for IFB No. 4	IDIAP	6/82
B23	Review of specs and bid documents for IFB No. 4	AID/P	7/82
B24	IFB No. 4 advertised	IDIAP/AID/P	8/82
B25	Preliminary bid award for IFB No. 4	GOP	10/82
B26	Definitive bid award/contracts issued for IFB No. 4	IDIAP	11/82
B27	Equipment procured through IFB No. 4 in country	IDIAP	4/83

(C) TECHNICAL SERVICES

ITEM	ACTION	ACTION AGENT	DATE
C1	Preparation of workscopes for short term procurement and research management specialists	IDIAP	8/79
C2	Review workscopes for procurement and research management specialists	AID/P	8/79
C3	Begin search for procurement and research management specialists	IDIAP/AID/P	8/79
C4	Select and contract procurement and research management specialists	IDIAP	9/79
C5	Initiate preparation of RFTP long term technical services	IDIAP	9/79
C6	RFTP completed	IDIAP	10/79
C7	RFTP reviewed	AID/P	10/79
C8	Announcement of RFTP	IDIAP/AID/P	12/79
C9	Preliminary selection of contractor	IDIAP	12/79
C10	Contract negotiations completed	IDIAP/AIDP Contractor	2/80
C11	Contract signed	AID/P	3/80
C12	Long term technical services on board	Contractor	5/80
C13	Long term technical services completed	Contractor	5/83

(D) TRAINING

ITEM	ACTION	ACTION AGENT	DATE
D1	Select participants for long term training in 1980;	IDIAP/MIDA/ MIPPE	8/79
D2	Identify training sites	MIDA/IDIAP/ AID	9/79
D3	Submit applications assure candidates are qualified (TOEFL, GRE scores if necessary)	MIDA/IDIAP/ AID/P	10/79
D4	Initiate long-term training	IDIAP/AID/P	1/80
D5	Develop short term training plan (in conjunction with first year implementation plan)	IDIAP	10/79
D6	Begin implementation of short term training activities	IDIAP	1/80
D7	Adjust short term training plan	IDIAP	1/81 & each year there-after
D8	Select participants for long-term training in 1981	IDIAP/MIDA/ MIPPE	3/80
D9	Identify training sites	IDIAP/MIDA/ AID /P	6/80
D10	Submit applications/assure candidates are qualified	IDIAP/MIDA/ AID/P	7/80
D11	Initiate 1982 long-term training	IDIAP/AID/P	1/81
D12	Select participants for long-term training in 1982	IDIAP/MIDA/ MIPPE	3/81
D13	Identify training sites	IDIAP/MIDA/ AID/P	6/81

ITEM	ACTION	ACTION AGENT	DATE
D14	Submit applications/assure	IDIAP/MIDA/ AID/P	7/81
D15	Initiate 1982 long-term training	IDIAP/AID/P	1/82
	(E) CONSTRUCTION		
E1	Begin A&E design for area sub-centers and regional facilities	IDIAP	9/79
E2	Review plans	AID/P	11/79
E3	Request for proposal issued	IDIAP	12/79
E4	Provisional bid awards		2/80
E5	Contracts signed	IDIAP-contractor	5/80
E6	Construction begins	Contractor	6/80
E7	Construction completed	Contractor	12/80
E8	Begin site study for Santiago national headquarters	IDIAP	12/79
E9	Complete site study national headquarters	IDIAP	2/80
E10	Land purchased or acquired	IDIAP/MIDA	4/80
E11	A&E design for national headquarters begins	IDIAP	4/80
E12	A&E design completed	IDIAP	7/80
E13	A&E designs reviewed and approved/bid document prepared	AID/P	8/80
E14	Request for proposals issued	IDIAP/AID/P	9/80
E15	Preliminary award	GOP	11/80

ITEM	ACTION	ACTION AGENT	DATE
E16	Definitive Award	IDIAP	1/81
E17	Contract signed	IDIAP Contractor	3/81
E18	Construction begins	Contractor	3/81
E19	Construction completed	Contractor	12/82
E20	Interior finishing	IDIAP	3/83
	(F) AREA FIELD RESEARCH		
F1	Organize diagnostic teams and begin training	IDIAP International Research Centers	1/80
F2	Complete training of diagnostic teams	IDIAP International Research Centers	3/80
F3	Initiate diagnostic studies in 4 areas	IDIAP International Centers - MIDA	3/80
F4	Complete diagnostic studies in 4 areas	IDIAP-MIDA- International Centers - T.A.	6/80
F5	Prepare area research plans for 4 areas	IDIAP-MIDA	6/80
F6	Review diagnostic studies area research plans and approve field research activities for 4 areas	AID/P	7/80
F7	Establish multi-disciplinary and field research teams in four areas	IDIAP	6/80
F8	Select on farm research sites in four areas	IDIAP-MIDA	7/80
F9	Begin research activities in four areas	IDIAP	8/80

ITEM	ACTION	ACTION AGENT	DATE
F10	Initiate diagnostic studies in second four areas	IDIAP	11/81
F11	Complete diagnostic studies in second four areas	IDIAP	3/81
F12	Prepare field research plans in second four areas		4/81
F13	Review diagnostic studies and area field plans for second four areas	AID/P	5/81
F14	Establish area field research teams for second four areas	IDIAP	5/81
F15	Select on farm research sites for second four areas	IDIAP-MIDA	6/81
F16	Begin research activities in second four areas	IDIAP	7/81
F17	Review and adjust area research plans	IDIAP	3/81 and thereafter

POST-GRADUATE TRAINING SCHEDULE FOR TECHNICAL AND PROFESSIONAL PERSONNEL 1980 - 1984

Specialty	Level	1980				1981				1982				1983				1984			
		3	6	9	12	3	6	9	12	3	6	9	12	3	6	9	12	3	6	9	12
Animal Nutrition	Ph.D.																				
Swine Production	Ms.																				
Animal/Crop Production System	Ms.																				
Animal Production	Ph.D.																				
Milk Production	Ms.																				
Livestock Improvement Systems	Ms.																				
Animal Breeding	Ph.D.																				
Tropical Pastures and Soils	Ms.																				
Tropical Pastures	Ph.D.																				
Animal Health	Ms.																				
Soil Productivity	Ph.D.																				
Crop Production Systems	Ms.																				
Entomology	Ms.																				
Crop Improvement Ecology	Ms.																				
Plant Genetics	Ms.																				
Plant Genetics	Ph.D.																				
Horticulture (Tropical)	Ms.																				
Anthropology	Ms.																				
Rural Sociology	Ms.																				
Seed Technology	Ms.																				
Plant Pathology	Ms.																				
Post-Production Technology	Ms.																				
Soil Classification and Productivity	Ms.																				

Specialty	Level	1980				1981				1982				1983				1984			
		3	6	9	12	3	6	9	12	3	6	9	12	3	6	9	12	3	6	9	12
Soil & Water Management	Ms.																				
Soil Fertility	Ph.D.																				
Nematology	Ph.D.																				
Irrigation	Ms.																				
Research Center Admin.	Ms.																				
Farm Management	Ms.																				
Farm Management	Ms.																				
Agricultural Economics	Ph.D.																				
Agricultural Economics	Ms.																				
Communication	Ms.																				
Communication	Ms.																				
Statistics	Ph.D.																				
Special 1-12 month training courses and programs for Ing. Agronomos plus participation in international seminars, conferences, etc.																					
Special 1-12 month training short courses and programs for Agronomos and other technicians, both in Panama and in other countries in collaboration with International Institutions and Organizations.																					
Special 1-12 month training courses and programs for administration personnel in research center administration, & planning, programming and budgeting.																					

Annex VII
Exhibit C

TECHNICAL ASSISTANCE SCHEDULE

SPECIALIST	1980	1981	1982	1983	1984	Person Months
1. Agricultural Engineer						36
2. Agricultural Economist/Farm Management Specialist						36
3. Specialist in Farmer Services Transfer of Technology, Training						30
4. Specialist in Soil Productivity and Water Management						24
5. Specialist in Tropical Pastures Production						24
6. Specialist in Animal Nutrition and Animal Production Systems						36
7. Short-term Specialties **	10	7	7	7	3	34
(Would include some or all, and possibly others, in the following specialties; Transfer of Technology, Applied Research, Rural Sociology, Anthropology, Evaluation, Plant Pathology, Animal Health, Soil Conservation, Crop Production Ecology, Pest Management, Editing, Communications, Publications, Production Systems, Plant and Animal Genetics, Planning and Research center administration and program management.						
Total						220

* Numbers indicates the number of person-months.

** The number of person-months indicated per year is approximate. It is intended to maintain some flexibility according to specific needs as the project progresses.

PRELIMINARY SCOPES OF WORK FOR LONG TERM TECHNICAL ASSISTANCE

IDIAP has developed preliminary scopes of work for the long term technical assistance positions which it has identified as being necessary to the successful implementation of the project. These scopes are presented below.

AGRICULTURAL ENGINEER

SCOPE OF WORK

To begin 4-8 months after project initiation and continue for 36 months. He/she should be trained and/or experienced in the planning and development of facilities for agricultural research, post-production technology, agricultural machinery (and especially small-scale mechanization or intermediate technology), general tropical agriculture production technology, alternative energy sources in agriculture, and research station operations.

Specialist should have at least an M.S. degree, with several years of practical experience, preferably in LDC tropical countries, and should write and speak fluently both Spanish and English.

He/she would:

1. Work in close association with IDIAP's directors and planners in the design and construction of headquarters and regional facilities and research facilities on experiment stations.

2. Assist in the final designs, construction and installation of equipment in IDIAP's three seed processing plants, and help carry out in-service training of personnel in the plants' operations.

3. Study and review existing post-production methods and systems (harvesting, threshing, drying, cleaning, storage), study harvesting and post-harvest problems, test technological alternatives, and validate recommended improved systems.

4. Study benefits and relative costs of various methods of land and seedbed preparations, weed control, mulching, and general feasibility of utilizing on-farm intermediate technology.

5. Help develop efficient utilization of on-farm alternative energy sources which might include low energy

alternatives, solar energy, wind and water power; recycling and utilization of by-products, building soil humus content and applying organic wastes.

6. Help improve and conduct training in research station and research facility operations.

AGRICULTURAL ECONOMIST/FARM MANAGEMENT SPECIALIST

SCOPE OF WORK

To begin 4-8 months after Project initiation and continue for 36 months. He/she should be trained and experienced in agricultural economics with a solid background in farm management and agricultural (including livestock) production systems.

The specialist should have at least 5 years of research and practical experience in production economics and economic analysis (Macro and Micro) with at least an M.S. degree. Experiences should also include diagnostic and feasibility studies, analysis of research project results, predictions and simulations, and market analysis.

Tasks would include:

1. Introduce in the area diagnostic studies, of small and medium farmers, socio-economics components.

2. Assist in analizing and interpreting the data obtained in order to characterize the production factors, set priorities on setting up on-farm research projects to solve the most urgent problems, and help design the experiments.

3. Carry out economic analysis of experimental results of completed projects and help determine the feasibility of alternative solutions.

4. Coordinate the integration of generated technology into different production systems and sub-systems, along with on-farm validation trials.

5. Participate in in-service training of IDIAP staff.

The Specilist should be able to write and speak fluently both Spanish and English, and be willing to travel considerably.

SPECIALIST IN FARMER SERVICES, TRANSFER OF TECHNOLOGY, TRAINING

SCOPE OF WORK

To begin about 4-8 months after Project initiation and continue for 36 months. General areas of expertise should include (1) Planning and implementing training programs for field workers and farmer leaders; (2) Communication and technology transfer techniques required by production specialists on the small/medium farmer level; (3) Experience in farming systems and in providing an integrated, problem-oriented, site-specific approach to production technology in general for basic food (crops/animals) commodities, and in-depth experience in the use of audio-visual and other group training techniques for promoting agricultural education activities.

Specialist should have at least five years of experience in the areas described above preferably in developing countries, have a base in farm management, and preferably hold degree credentials at least at the Masters Level.

Tasks would include:

(1) Help plan, develop and implement training programs for production/change agents who will work with participating farmers and farm groups in the priority and expanded areas.

(2) Help develop and promote IDIAP's long-range capabilities in providing farmer services and farmer-service training, including continual information backstopping for the technology transfer and adaptive research personnel.

(3) Help strengthen adaptive production research efforts at the farm level, working cooperatively with the adaptive research specialists and field production specialists. Areas of special concern would include improved cultural practices, integrated combined crops/livestock farming systems, soil productivity and conservation practices, integrated pest management, weed control, and comprehensive land-use planning that would be conservation-oriented for decreasing ecological degradation.

(4) Help develop and provide for teaching service to smallest farmers through the use of farm bulletins, farm budgets, audio-visual aids, on-farm demonstrations of developed, adapted, and validated technology production systems, and field workshops to address production constraints.

(5) Help promote the participation of area representatives and field offices of all rural sector agencies (MIDA, BDA, IMA, Reforma Agraria, Rural Sociology, etc.) to provide an integrated approach to conducting on-farm applied research training and dissemination activities for the Project target areas and small farmer groups.

(6) Help develop and implement evaluation procedures for "farmer service" performance in the priority areas.

Specialist should be able to speak and write Spanish and English fluently.

SPECIALIST IN SOIL PRODUCTIVITY AND WATER MANAGEMENT

SCOPE OF WORK

To begin approximately eighteen months after Project initiation and continue for 24 months with provision for two one-month consulting periods during the following two years. His/her background and training should be in soils,agronomy, and natural resource management. He/she would:

1) Participate in inter-disciplinary applied research teams to determine the most effective uses of natural resources (climate, land and soil, vegetation), and in the general areas of water management and soil improvement for better production efficiency.

2) Concentrating in the priority areas, work on soil fertility evaluation, improvement, and maintenance programs, in order to help remove one of the major factors limiting crop production in Panama. This would include studying fertility requirements for a wide variety of soils, since requirements differ greatly depending upon their capacity to fix phosphorous, needs for lime, various micro-element deficiency and other factors.

3) Help plan and implement area-specific on-farm investigation studies for enhancing soil productivity and water management and for the integration fo soil and water use factors into

good land use and productive livestock/cropping systems consistant with farm size and recommended farming practices.

4) Help identify and solve institutional and policy factors (legal, social, economics, manpower, credit, education, etc.) which influence efficient soil management and soil conservation practices as well as the distribution and management of water on the farm level.

5) Assist in in-service training of IDIAP staff as well as production agents and farm leaders in soil and water management practices.

Specialist should have at least five years of experience in the general areas described preferably in developing tropical countries, hold degree credentials at least to the M.S. level, and be proficient in both Spanish and English.

SPECIALIST IN TROPICAL PASTURE PRODUCTION

SCOPE OF WORK

To begin about 16 months after Project initiation and continue for 24 months. He/she would be trained and experienced in soils and pasture production in tropics and with a solid background in statistics, animal production in the tropics, and animal forage evaluation.

He/she would:

(1) Work as a member of an inter-disciplinary team in the development of improved production systems for dual purpose (beef/milk) cattle.

(2) Assist in the planning, programming and execution of experiments for selecting the best pasture/legume crops for tropical conditions with special reference to low inputs, ease of establishing, and for simple management practices.

(3) Analize and interpret the generated information and integrate it with other components in beef/milk production systems.

(4) Assist in the dissemination of the information both written and orally, in on-farm trials and demonstrations, seminars, field days, conferences, and with various types of publications including farmer oriented bulletins.

(5) Collaborate in implementing the best alternative technologies with farmer collaboration in selected priority areas.

(6) Participate in in-service training of IDIAP staff in the various specialties and areas described above.

(7) Collaborate in diagnostic studies and in the elaboration of research and technology transfer programs.

He/she should be trained preferably to the Ph.D. level and have at least 5 years of experience with a minimum of 2 years under tropical conditions. He/she should write and speak fluently both Spanish and English, and be willing to travel considerably. The place of residence would be David, Chiriqui.

SPECIALIST IN ANIMAL NUTRITION AND ANIMAL PRODUCTION SYSTEMS

SCOPE OF WORK

To begin about 4-8 months after Project initiation and continue for 36 months. He/she would be trained and experienced in animal nutrition in tropics and with a solid background in statistics and animal production in the tropics.

He/she would:

1) Work as a member of an inter-disciplinary team in the development of improved production systems for dual purpose (beef/milk) cattle and other animal production programs.

2) Assist in the planning, programming and execution of experiments for selecting the most efficient, economical and practical livestock feeding programs requiring unsophisticated management practices.

3) Analize and interpret the generated information and integrate it with other components in beef/milk production systems, as well production systems for small animals.

4) Assist in the dissemination of the information both written and orally, in on-farm trials and demonstrations, seminars, field days, conferences, and with various type of publications including farmer oriented bulletins.

5) Collaborate in implementing the best alternative technologies with farmer collaboration in selected priority areas.

6) Participate in in-service training of IDIAP staff in the

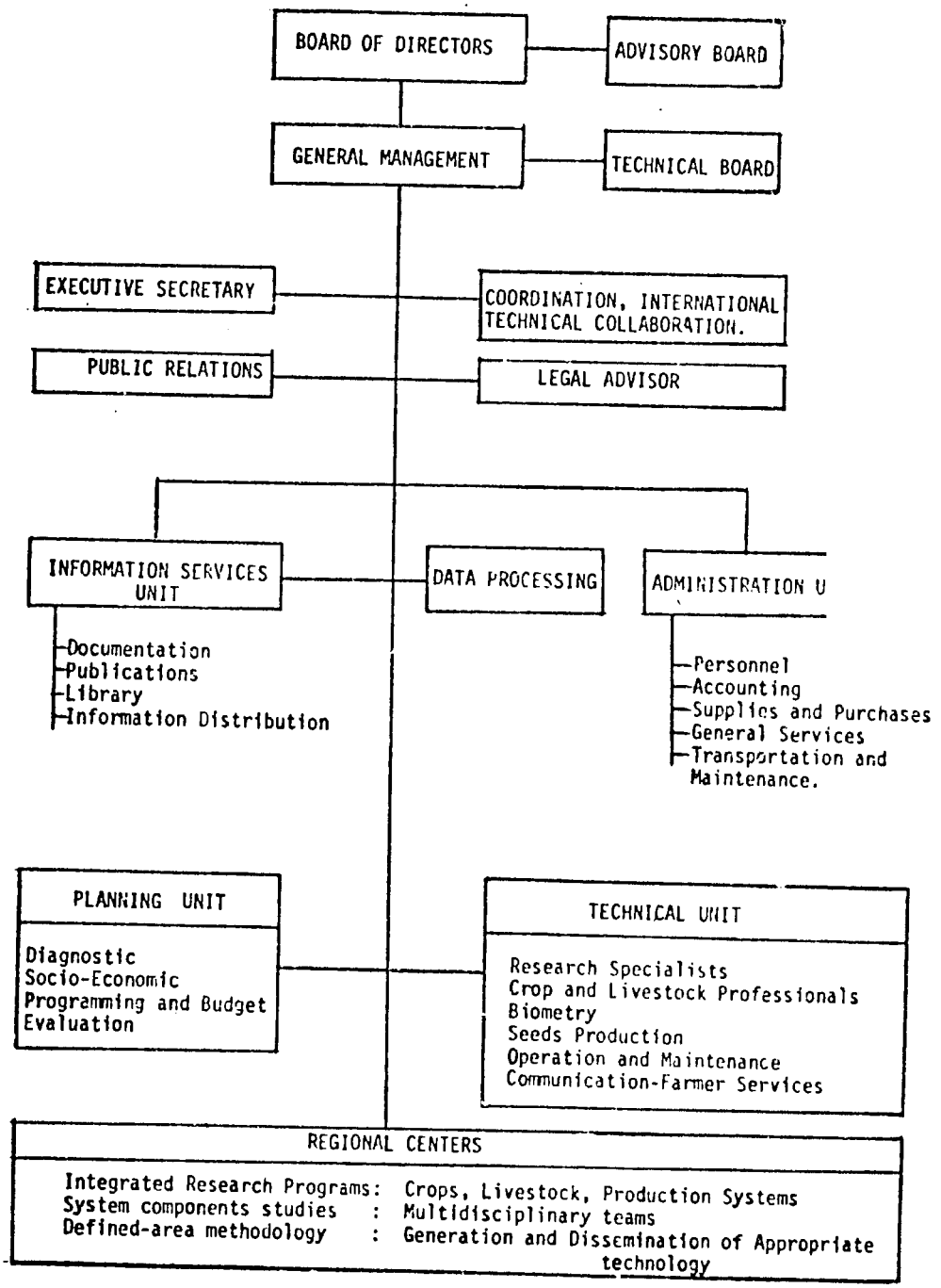
various specialties and areas described above.

7) Collaborate in diagnostic studies and in the elaboration of research and technology transfer programs.

He/she should be trained preferably to the Ph.D. level and have at least 5 years of experience with a minimum of 2 years under tropical conditions. He/she should write and speak fluently both Spanish and English, and be willing to travel considerably.

Annex VII
Exhibit E

IDIAP PROPOSED ADMINISTRATIVE STRUCTURE



IDIAP's STAFFING PATTERN, 1979

1. Director General - Ing. Damaris Chea
   Sub-Director Ceneral - Dr. Alberto Perdomo (Acting Tech. Dir.)

2. Technical Committee - Ing. Irma Arjona
   Dr. Alberto Perdomo
   Dr. Rolando Lasso
   Dr. Santiago Rios
   Dr. Gaspar Silvera
   Ing. Humberto Ruiloba
   Ing. Felix Estrada

3. Executive Secretary - Lic. Maria del C. de Name

4. Coordinator, International Programs - Jack Dee Traywick, Acting, Position not yet filled.

5. Head of Information Services Center - Lic. Vielka Chang, M.A.

6. Legal Adviser - Not yet appointed. IDIAP uses MIDA's lawyer on part time basis.

7. Head of Public Relations - Sr. Alberto Velasquez (part-time).

8. Director, Administration and Finances - Lic. Freddy Calderon
   Sra. Marianela de Rodriguez, Administrator, Panama Offices
   Sra. Tomasa de Vega, Administrator, Chiriqui

9. Director, Planning and Budget - Ing. Vernon Carlos Wyinter
   (Position for Socio-economist not yet filled)

10. Regional Centers -
    a. Chiriqui - Dr. Santiago Rios, Regional Director
    b. Veraguas - Ing. Jorge Gonzalez, Regional Director
    c. Panama - Agron. Ismael Aguilar, Regional Coordinator. (acting)

11. Other Divisions -
    a. Biometrics - Ing. Irma Arjona, Head, MSc.
       Ing. Florentino Vega, MSc.
    b. Data Processing - Lic. Lourdes Gallardo
    c. Publications - Lic. Elizabeth Ruiloba, MS.
    d. Operations and Maintenance - Not yet appointed.

12. Research Specialists -

	Percentage of time in Technology Transfer (approx.)
a. Ing. Rafael Flores, Irrigation	30%
b. Dr. Gaspar Silvera, Soybean Program	20%
c. Adais Gonzalez, Agron. Soybean Program	20%
d. Ing. Roberto Rodriguez, Potato Program	50%
e. Franklin Atencio, Agron. Potato Program	50%
f. Dr. Rolando Lasso, Rice and Tomato Programs	10%
g. Ing. Ricardo Morales, Rice Program	50%
h. Ing. German de Leon, Tomato Program, MSc.	20%
i. Ing. Eric Candanedo Lay, Nematologist, MSc.	0
j. Dr. Alberto Perdomo, Entomologist	20%
k. Ing. Allen Rourk, Entomologist, MSc.	20%
l. Ing. Gabriel Von Lindeman, Weed Control, MSc.	50%
m. Lic. Alfonso Singh, In charge of Soil Testing Laboratory	10%
n. Ing. Arais Cajar, Yucca and Sugar Care Programs	20%
o. Ing. Benjamin Name, Soils, MSc.	30%
p. Ing. Pedro Him, In charge of Basic Seed Production Program	0
q. Ing. Gonzalo Gonzalez, Technical Secretary, National Seed Committee	0
r. Ing. Bolivar Pinzon, Tropical Pastures (Soils) Program MSc.	30%
s. Ing. Carlos Ortega, (In charge) Tropical Pasture Program, MSc.	20%
t. Vet. Jorge Gomez, Milk Production Program	0
u. Vet. Mario A. Florez, Animal Health	50%
v. Ing. Miguel Acosta, Transfer of Technology (Field days, Seminars, Short courses, etc.)	100%

13. Production Programs* in Priority Areas.

A. Regional Center - Chiriqui

1. Sub-Center Gualaca - Dual Purpose Beef/Milk Program for Small and Medium Producers

5 Five staff members for national program (Economist, Nutritionist, Tropical Pastures, Animal Production, Animal Health).

* These staff members work 100% of their time in the generation, adoption, evaluation, validation and transfer of appropriate technology.

3 2. Sub-Center Cerro Punta -
Ing. Roberto Rodriguez, Agronomo Franklin Atencio,
1 Agronomo (To be appointed in June, 1979).

3 3. Caisan - Priority Area
Ing. Jose R. Arauz
Agro. Andres Gonzalez
Agro. Juan C. Ruiz

2 4. Baru -
Ing. Ricardo Morales
Agronomo (not yet appointed)

B. Regional Center - Veraguas (Cocle, Azuero)

2 1. Sur de Sona
Ing. Luis A. Hooper
Agro. Oscar Rodriguez

2 2. Montijo - Dual Purpose Beef/Milk Project
Agro. Edgar Peña
Agro. Manuel Pinilla

3 3. Santiago/La Mesa/Canazas Priority Area
Calabacito Farm (Testing, Demonstration trials, etc.
adaptive research) is located within this area
1 Ing. Agro., Ing. A. Zambrano
2 Agronomos.

2 4. Los Santos - Dual Purpose Beef/Milk Project
Agro. Juan B. de Leon
Agro. Raul Gonzalez

There are 22 Staff members (equivalent full-time) working in the priority Area Programs who are involved in the Generation/Validation/Dissemination and Appropriate Technology. In addition, most of the research specialists spend a portion of their time in technology transfer programs. This activity is equivalent to 6 additional full time staff members working in the technology transfer area.

Since 3 of the positions are not filled as yet, IDIAP has a total fo 26 full-time staff (or full-time equivalents counting the

specialists who spend a percentage of their time working in the over-all area of farmer services, technology evaluation and technology transfer. This amounts to almost 40% of the total professional staff (including Agronomos), and is considered significant progress. One year ago only about 10% of the staff were involved in the general area of farmer services.

Annex VIII
Exhibit A

AGRICULTURAL TECHNOLOGY DEVELOPMENT
PROJECTION OF EXPENDITURES BY FISCAL YEAR
(US $ 000)

Component	FY 80 AID	FY 80 GOP	FY 81 AID	FY 81 GOP	FY 82 AID	FY 82 GOP	FY 83 AID	FY 83 GOP	FY 84 AID	FY 84 GOP	TOTAL AID	TOTAL GOP	GRAND TOTAL
I. Area Focused Research Activities													
A. Construction	209	54	173	97	0	40	69	169			451	360	811
B. Equipment and Material.													
1. Field Equipment	127	0	138	25	87	25	51	0	15	0	428	50	478
2. Research Inputs	40	19	123	57	150	69	148	69	131	62	592	276	868
3. Seed Processing			142	0	56	0					198	0	198
4. Laboratory			8	0	16	0	8	0			32	0	32
5. I, E and C		10	25	10	25	10	25	10	25		100	40	140
6. Office Equipment & Furniture			5	0	10	0	5	0			20	0	20
7. Workshop	8	0	30	0	5	0	4	0	4	0	51	0	51
C. Vehicles	89	0	245	70	88	70	0	73			422	213	635
D. Technical Assistance	149	0	406	0	412	0	187	0	56		1,210	0	1,210
E. Operational Costs													
1. Salaries, IDIAP		449		566		745		870		954		3,584	3,584
2. Fuel, Maintenance		30		60		120		145		145		500	500
3. Salaries, MIDA		80		128		128		128		128		592	592
F. Complementary Research Activities			50		100		150		200		500	0	500
Sub-Total	622	642	1,345	1,013	949	1,207	647	1,464	431	1,289	3,994	5,615	9,609
II. Institutional Development													
A. Construction	0	165	702	432	181	221	0	72			883	890	1,773
B. Equipment and Materials													
1. Laboratory			50	0	100	0	50	0			200	0	200
2. I, E and C			30	0	20	0	32	0			82	0	82
3. Office Equipment and Furniture	16	0	50	40	102	50	23	21	0	7	191	118	309
C. Vehicles			0	10	0	27	0	10			0	47	47
D. Technical Assistance	37	0	100	0	102	0	47	0	14	0	300	0	300
E. Training	170	54	394	22	424	19	229	5	133	0	1,350	100	1,450
F. Operational Costs													
1. Salaries, IDIAP		32		32		32		32		32		160	160
2. Fuel, Maintenance				5		20		20		45		70	70
Sub-Total	223	251	1,326	541	929	369	381	160	147	64	3,006	1,385	4,391
Total	845	893	2,671	1,554	1,878	1,576	1,028	1,659	578	1,418	7,000	7,000	14,000

Annex VIII
Exhibit B
Table I

PROJECT EQUIPMENT AND MATERIALS REQUIREMENTS SUMMARY

Line Item	Description	Total Cost
1.	Tractors with full sets of implements, rotovators, field choppers, planters, cultivators, trailor, etc.	
	a) Six 50-70 h.p. $28.00 ea.	$168,000
	b) Ten 20-40 h.p. $18.00 ea.	180,000
2.	Misc. field equipment, hand tools, portable testing kits and instruments, etc.	70,000
2a.	Research and demonstrational equipment, instruments, tools	50,000
3.	Seed processing equipment - One complete plant and two very simple sets of equipment for processing basic, foundation, research, and demonstration seed. With spare parts and tools. Two facilities include drying equipment.	120,000
4.	Seed Storage equipment. For three small storage centers. Air conditioning, dehumidifiers, testing and maintenance equipment, instruments, tools and spares.	78,000
5.	Air conditioning equipment for offices, laboratories, auditorium, etc. Information Service Center, Conference and training rooms, Data processing center, etc.	80,000
6.	Laboratory equipment for all locations.	232,000
7.	Equipment for Communication and Information Service Center.	82,000
8.	Materials for educational purposes, printing, photography, libraries, training, etc.	140,000
9.	Office and Staff Equipment.	329,000
10.	Office Furniture.	126,000
11.	Workshop equipment and tools. All locations.	51,000
	TOTAL	$1,706,000

PROJECT VEHICLE REQUIREMENTS — 5-YEAR PERIOD

Description	1st	2nd	3rd	4th	5th	Unit Cost	Total Costs
1. Utility Vehicle, 4-wheel drive, four passenger diesel or gasoline engine.	8	8	5			8,000	168,000
2. Pick-up 1/2 ton, four-wheel drive. Canvas roof over bed. Diesel of gasoline.	6	4	3			8,000	104,000
3. Pick-up, 1/2 ton, standard transmission. Canvas roof over bed. Diesel or gasoline.	2	2	2			7,000	42,000
4. Sedan or Station Wagon. Small 4-Passengers. Preferably 4-wheel drive.	2	4	4			7,000	70,000
5. Small Sedan or Station Wagon. (for Directors, Research Staff, Consultants).	5	3	2	2		8,000	96,000
6. Mini-Bus. 8-Passenger, fully-equipped.	4		4			12,000	96,000
7. Bus. 30-Passenger, fully equipped.		2				22,000	44,000
8. Truck. 5-Ton. Wooden, heavy duty bed. Diesel engine.	2					13,000	26,000
9. Truck. 5-Ton flat bed. Stakes diesel engine. For hauling equipment, fertilizer, etc.		2				12,000	24,000
10. Motorcycle.	4	4				900	7,200
11. Motor-scooters	3	3				600	3,600
12. Bicycles.	6	6				100	1,200
					TOTAL		$681,000

PHYSICAL FACILITIES

	Estimated Area	Estimated Cost/m^2	Estimated Total Cost
I. National Center Headquarters-Santiago a-h Plan I	Sq. meters		
a. Administrative Offices, Accounting, Reception, Research and Dissemination Staff Offices, Technical Collaboration offices, Toilets.	1,040	300	312,000
b. Auditorium - conferences, short courses, etc.	300	320	96,000
c. Conference and Work Session rooms 2-4 x 8, 1-5 x 12	120	220	26,400
d. Multi-purpose Laboratories - Soils, Entomology-Plant-Pathology, Seed Quality, Weed Control, Integrated Pest Management,etc.	240	325	78,000
e. Information Service Center, Library, Documentation Centers. (Printing, Visuals, Publications, Distribution, Photographic).	400	200	80,000
f. Data Processing	60	200	12,000
g. General Services - Warehouse, Storage Rooms	200	120	24,000
h. Cafeteria - Kitchen, Dining room, Cold Storage room, Toilets, Store-room.	260	250	65,000
i. Workshops - Mechanic and Carpentry - Plan II	100	120	12,000
j. Vehicle Shed - Plan III	180	80	14,400
k. Seed Processing Plant Basic Seed Program - Plan IV	130	350	45,600
l. Seed Drying Shed for Bagged Seed Drying 96 bag capacity - Plan IV	100	250	25,000
m. Seed Storage Rooms-2 levels of storage conditions - Plan IV (Short-term and long-term storage)	200	300	60,000

n. Greenhouses - 4x40m^2. Screen-houses, Low cost, Plastic Roof Gravel floor, wood tables.	160	100	16,000
o. Designs, Architects and Engineer fees, Site development utilities			317,000
p. Interior Finishing and Decorating, Built-in Furniture, Equipment. Light-ing Fixtures, etc.			255,000
II. Regional Centers			
A. Chiriqui (and Bocas del Toro0			
1. David-Regional Office, Con-ference Rooms, Accounting, 3 offices for visitors and staff. (Location may be out-side of the city). Plan V	230	300	69,000
Storage Room Vehicle shed or garage	150	150	22,500
2. Gualaca Sub-Center -Priority Area (Beef Milk/Pastures pro-grams, small ruminants, model farm for dua-purpose animals, production systems), Expansion of offices, remodelling exist-ing office building and old offices for dormitory (70m^2), add to and improve laboratory, improve water supply system, build crop drying facilities for pasture, and by-product re-search, greenhouse (30m^2), new bodega storerooms (50m^2), im-prove utilities, improve corrals miling shed, etc. (No plans de-veloped as yet).			102,000
3. Cerro Punta Sub-Center Pri-ority Area - Potato and Vege-table Programs. Build Labo-ratory (24m^2), Storage Room (80m^2) Greenhouses (60m^2).Re-model Offices. Similar in const. to Plan VI	164	250	41,000

4. Alanje Sub-Center-for crops and Integrate Production Systems. Plan VI	160	150	24,000
Offices, Conference Room and small laboratory ($80m^2$); Storage Rooms ($80m^2$), Workshop, and Shed ($70m^2$); work rooms ($95m^2$), Utilities - Sewage and Waste Disposal.			
5. Bocas del Toro Sub-Center - Similar to Alanje Office and Conference Room ($300m^2$), Work Room and Storage ($120m^2$), Work Storage Shed ($100m^2$), Dormitory ($30m^2$). See Plan VI	160	250	40,000
6. Caisan - Priority Area Multi-purpose building with office, toilet, storerooms, implement and tool shed. Dormitory. Plan VII	160	150	24,000
7. Baru - Priority Area - (Same as Caisan) Plan VII	160	150	24,000
B. Veraguas and Azuero			
1. Santiago National Center Headquarters (See No.1)			
2. Calabacito Farm Sub-Center - (Priority Area) Multi-purpose storage building -	180	120	21,600
Workshop - mechanic and carpentry and workrooms	80	100	8,000
Corrals, irrigation system, remodelling existing structures. New construction will be similar to Plans II and VI (Store rooms).			37,000
3. Azuero Sub-Center-Fruits and Vegetables (Priority Area) Cattle and Crops (Los Santos). Multi-purpose building with office small lab. workspace, storerooms, tools and implement shed. Plus			

greenhouse. Equipped and installed. Similar in construction as Caisan building	160	150	24,000
4. Sur de Sona. Priority, Impact Area. Same as Caisan Plan VII	160	150	24,000
5. Montijo District. Priority Impact Area. Similar to Caisan Plan VII.	160	150	24,000
C. Panama Regional Center			
1. Sub-Center Bayano. Offices ($20m^2$), Small laboratory ($20m^2$), Greenhouse ($30m^2$), Storage Room ($30m^2$), Conference Room ($20m^2$), Workshop and Workrooms ($50m^2$), Seed Processing Room and Seed Storage Rooms ($100m^2$) Seed drying shed ($30m^2$). Similar in construction to Plans II, IV, VI.	300	180	54,000
D. Engineering and architectural costs plus site development in addition to Headquarters center			110,000
III. Contingency Fund for all construction projects.			490,700
	TOTAL		$2,584,000

SEP 6 1979

ACTION MEMORANDUM FOR THE ASSISTANT ADMINISTRATOR (LAC)

FROM: LAC/DR, Marshall D. Brown

Problem: To authorize an FY 79 Loan ($6,000,000) and Grant ($1,000,000) for the Panama Agricultural Technology Development project.

Discussion: The purpose of the project is to: (a) enhance the Government of Panama's (GOP) capability to carry out on-farm adapative research; and (b) initiate or expand implementation of small-farmer-oriented research activities in eight priority areas of Panama. The project will increase the productivity of land and labor held by, and eventually the incomes of, small and medium sized farmers.

The project will finance technical assistance, training, equipment and materials, and construction to help the GOP's Applied Agricultural Research Institute (IDIAP) to: (1) improve its institutional capability; (2) conduct research activities in eight priority agricultural areas; and (3) carry out other complementary agricultural research. Research in the areas will follow a production system methodology that emphasizes on-farm research, validation, demonstration, and dissemination. The complementary research component will include such activities as integrated pest management.

The total cost of the project is $14 million, of which $7 million (50%) will be financed with A.I.D. funds -- $6 million of loan and $1 million of grant funds. The remaining $7 million will be financed with GOP counterpart funds. A.I.D.'s grant resources will be used to finance long-term U.S. technical assistance. Its loan resources will be used to finance local and third country technical assistance ($510,000), training ($1,350,000), construction ($1,335,000), equipment and materials ($1,885,000), vehicles ($420,000) and complementary research ($500,000).

The DAEC reviewed and approved the project on August 1, 1979, subject to several minor modifications to the project paper and the addition of a condition precedent to disbursement. The modifications include: (1) a clarification that IDIAP would contract only for research that was directly related to the area focused production systems research program and (2) inclusion of recent additions to the Statutory Project Checklist. The new condition precedent to disbursement of funds for activities financed through the IDIAP contract research fund requires that IDIAP prepare a plan for the utilization of the contract research fund. In addition, an Initial Environmental Examination (IEE) recommending a negative determination was rejected because of the planned procurement of pesticides under the project and an Environmental Assessment (EA) dealing with that issue was prepared.

The project was included in the FY 79 Congressional Presentation as a shelf item for both the grant and loan elements. Therefore, an Advice of Program Change was sent to Congress on August 13, 1979. The waiting period expired on August 27, 1979. In addition, a 653(b) notification was required because of an increase in the total country funding level. The waiting period for that notification expired on September 6, 1979. The LAC Bureau's Environmental Specialist reviewed the EA discussed above and found it to be acceptable.

Recommendation: That you sign the attached Project Authorization and Request for Allotment of Funds.

Attachment: a/s

DEPARTMENT OF STATE
AGENCY FOR INTERNATIONAL DEVELOPMENT
WASHINGTON, D.C. 20523

ASSISTANT
ADMINISTRATOR

Loan No. 525-T-050
AID/LAC/P-028

PROJECT AUTHORIZATION AND REQUEST FOR ALLOTMENT OF FUNDS

Name of Country: Panama

Name of Project: Agricultural Technology Development

Project Number: 525-0180

Pursuant to Section 103 of Part I, Chapter 1 of the Foreign Assistance Act of 1961, as amended, I hereby authorize a Loan and a Grant to the Republic of Panama (the "Cooperating Country") of not to exceed Six Million United States Dollars ($6,000,000) (the "Authorized Loan Amount") and Five Hundred Thousand United States Dollars ($500,000) (the "Authorized Grant Amount") to help in financing certain foreign exchange and local currency costs of goods and services required for the project described in the immediately following sentence. The project will finance technical assistance, training, equipment and materials and construction which will assist Panama's Applied Agricultural Research Institute (IDIAP) to establish an agricultural research capability and to conduct research activities in approximately eight priority areas of Panama.

I approve the total level of AID appropriated funding planned for this project of Seven Million United States Dollars ($7,000,000), of which $6,000,000 will be Loan funded and $1,000,000 Grant funded, including the funding authorized above, during the period FY 79 through FY 1980. I approve further increments during that period of Grant funding up to $500,000, subject to the availability of funds in accordance with AID allotment procedures.

I hereby authorize the initiation of negotiation and execution of Project Agreements by the officer to whom such authority has been delegated in accordance with AID regulations and Delegations of Authority, subject to the following essential terms and covenants and major conditions, together with such other terms and conditions as AID may deem appropriate:

A. Interest Rate and Terms of Repayment

The Cooperating Country shall repay the Loan to AID in United States Dollars within twenty (20) years from the date of first disbursement of the Loan, including a grace period of not to exceed ten (10) years. The Cooperating Country shall pay to AID in United States Dollars interest from the date of first disbursement of the Loan at the rate of (a) two percent (2%) per annum during the first ten (10) years and (b) three percent (3%) per annum thereafter, on the outstanding disbursed balance of the Loan and on any due and unpaid interest accrued thereon.

B. Source and Origin of Goods and Services

Except for ocean shipping, goods and services financed by AID under the Loan shall have their source and origin in the Cooperating Country or in countries which are included in AID Geographic Code 941, except as AID may otherwise agree in writing. Ocean shipping financed under the Loan shall be procured in the United States or in the Cooperating Country, except as AID may otherwise agree in writing. Goods and services financed by AID under the Grant shall have their source and origin in the Cooperating Country or in the United States except as AID may otherwise agree in writing. Ocean shipping financed under the Grant shall be procured in the United States, except as AID may otherwise agree in writing.

C. Condition Precedent to Initial Disbursement

Prior to any disbursement, or to the issuance of any commitment documents under the Project Agreement(s), the Cooperating Country shall furnish in form and substance satisfactory to AID:

1. A detailed implementation plan for the first year of the Project that provides a schedule for the procurement of Project inputs including technical assistance, training, and commodities; that outlines the Cooperating Country actions required prior to use of the Project inputs; and that describes how such input will contribute to Project activities.

D. Conditions Precedent to Disbursement for Field Activities in Each Geographic Area

Prior to any disbursement, or to the issuance of any commitment documents under the Project Agreements for field

research and validation trials in each of the approximately eight priority geographic areas, the Cooperating Country shall furnish in form and substance satisfactory to AID:

(1) Evidence that required diagnostic studies have been completed and analyzed and a research plan developed for such geographic area, which shall include an analysis of the need for complementary inputs and a description of the arrangements for obtaining them.

(2) A plan from the Ministry of Agricultural Development which describes the role, personnel and other contributions of each institution that will be involved in the dissemination of the results of the research to Panamanian small farmers, including a specific plan for the participation and training of Ministry of Agricultural Development personnel in this activity.

(3) A detailed plan for the use of long-term technical assistance in carrying out the research activities and evidence that arrangements have been made to obtain the technical services specified in the plan.

E. Condition Precedent to Disbursement from the Research Fund

Prior to any disbursement, or to the issuance of any commitment documents under the Project Agreements for research contracts financed by the IDIAP research contracts fund, IDIAP will furnish in form and substance satisfactory to AID, a plan for the use of such funds.

F. Covenant

The Cooperating Country covenants that, prior to the procurement or use of any pesticide financed under the Project agreement(s), it will confer with AID/Panama regarding the proposed procurement or use of the pesticide and will jointly prepare with AID/Panama and describe in writing a plan as to how the pesticide will be used and the safeguards to be followed.

Edward W Coz
Assistant Administrator
Bureau for Latin America
and the Caribbean

Sept 7 1979
Date

Clearances:

GC/LAC, J. Kessler JK/HW date 9/5/79
LAC/DR, C. Leonard CL date 9/6/79
LAC/DR, R. Mathia RM date 9/6/79
LAC/DR, M. Brown MB date
LAC/CEN, W. Luken WL date 9/6/79

Drafted:GC/LAC:SWhitman:ec:8/16/79:x29182
Revised:GC/LAC:SWhitman:ec:9/5/79