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**TROPICAL AGRICULTURAL RESEARCH AND TRAINING CENTER**

**(CATIE)**

**Turrialba, Costa Rica**

**A PROPOSAL TO FINANCE A REINFORCEMENT  
OF CATIE'S CORE PROGRAM**

**December, 1974**

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**PART I**

EXPLANATORY NOTES

This financial proposal for obtaining support for CATIE's Core

Program is presented in two parts.

The Proposal as such, with its explanatory tables, constitutes the first part. The presentation is simple and straight forward to facilitate its study. The first part is presented in two sections: one is on the support for the Core Research Program, and the other is on the Training Program. This separation is due to the fact that the formal Training Program is functioning under the terms of an Agreement with the University of Costa Rica, although the Program is financed almost entirely by CATIE. However, the requested support will permit CATIE to project training to the countries in the immediate area.

The second part of this Report --in addition to the statistical tables containing general information to give an idea of the current situation in the Central American countries-- includes information on each of the four Programs separately, in greater detail.

This presentation has resulted in a concise report, which includes all the pertinent information relative to the Institution and its activities.



CATIE'S SITUATION AND ITS NEED FOR THE SUPPORT OF ITS

CORE PROGRAM

a. INTRODUCTION

The problem of food production confronting the world today becomes more serious every day; and therefore the need to find a solution becomes even more urgent.

The only possible alternative is to increase production. It has been shown that productivity capacity can be increased considerably. The Green Revolution is an example of the enormous possibilities that exist so as to obtain increases in production, using improved seed and technological advances. However, this is only one aspect of the problem. A recent report published by the United Nations\* examines the problems encountered with the introduction of high yielding seed with respect to the integral solution of the world's hunger problem. It has to be admitted that agricultural production in general, independent of the size of the production unit, is a complicated task, due to the series of factors involved in the process, i.e.: physical (resources), environmental, organizational, biological aspects, etc. However, research on these factors will have little impact if not carried out in an integral manner, within the agricultural systems, ensuring a more rational use of the resources available to the farmer such as: land, labor and input; simultaneously taking into account the typical conditions and characteristics of the farmer's own ecological environment.

To date, food production is concentrated --for the most part-- in the developed countries of the temperate zones. The contribution from tropical

\* RESEARCH ON SOCIAL AND ECONOMIC IMPLICATIONS OF LARGE-SCALE INTRODUCTION OF NEW VARIETIES OF FOOD GRAINS (GLO/71/002) - Summary of Conclusions by United Nations Research Institute for Social Development (UNRISD), Geneva.

areas is not commensurate with its real potential. There are several factors in these areas that permit the production of a biomass per unit area far superior to that produced in the temperate zones. In the geographical belt between the Tropics of Cancer and Capricorn, solar rays -- the source of all energy -- are in a more vertical position, thereby producing more irradiation and more uniform temperatures throughout the year, thus allowing continuous vegetative growth.

The following are mentioned as examples of favorable production results due to these factors:

- 1) Pastures can produce 35 tons of dry matter per hectare per year as against 20 in the temperate zone.
- 2) The production of one kilogram of meat in the United States of America requires 20 kilograms of grain-based concentrates; in the tropics, the equivalent weight of meat can be produced without any grain concentrates.
- 3) The utilization of agricultural systems that imply the association of crops in different combinations and sequences permit the continuous use of the soil for cumulative periods of 450 days per year, and a biomass production of 50 tons per hectare per year.
- 4) The vegetative growth of a coniferous forest plantation (Pinus caribaea) can produce as much as 30-40 cubic meters, against 20 cubic meters, the maximum production of temperate zone forests of Pinus maritima.

It must be recognized that although the potential exists, its adequate utilization is difficult. Considerable research oriented towards

promotional aspects is needed. This implies the need for establishing a truly cooperative system among the regional international organisms and the countries.

This is precisely the aim of CATIE's Program, which is dedicated exclusively to studying agricultural production systems involving crops and basic grains, meat and milk, and wood. These systems permit intensive land use, which implies the full utilization of labor, and the adequate utilization of capital and input.

#### b. THE ECONOMIC CHARACTERISTICS OF THE REGION

The countries of Central America and the Antilles towards whose development CATIE is mainly directing its efforts, are characterized by having basically agricultural economies, since the major part of their populations depend on agriculture for subsistence. In these countries, 75 per cent of all the agricultural units belong to small farmers who farm small pieces of land (5 hectares or less), unprofitably. Nonetheless, these farmers contribute substantially to the production of basic food crops. (See Appendix N°1).

The Central American countries have understood that they must integrate their economies in order to attain any real development. There is a Common Market, and a regional organism was created for its development: the Secretariat for Central American Economic Integration (SIECA), responsible for all the economic studies involved in the integration process.

There is also the Central American Bank of Economic Integration (BCIE), created for the development of infrastructure projects, aimed at making the development process possible, and the financing of important projects, especially those of a regional nature. There are other regional endeavors worthy of mention, such as the Central American University Council (CSUCA), which has as its objective the coordination of university teaching in the

area; the International Plant and Animal Quarantine Organization (OIRSA), dedicated to the integral control of agricultural pests and diseases; and the Central American Cooperative Program for Food Crops Improvement (PCCMCA) responsible for promoting basic food crops production. In addition, there are two international organisms: the Nutrition Institute for Central America and Panama (INCAP) and CATIE; the first is dedicated to research fundamentally on problems of human nutrition; and the second is dedicated to agricultural research and training.

Originally, the Common Market was dedicated to industrial development. However, it soon became apparent that it could not neglect the agricultural aspect, now considered of first priority.

#### c. CATIE'S FUNCTION

The Tropical Agricultural Research and Training Center (CATIE) is an international organism constituted as a Civil Association, under Agreement between the Government of Costa Rica and the Inter-American Institute of Agricultural Sciences of the OAS (IICA). This Agreement was ratified by Law N°5201 and provides CATIE and its International Professional Personnel the same rights and prerogatives that IICA enjoys.

The maximum authority of CATIE is constituted by a Board of Directors comprised of two representatives of IICA, two representatives of the Costa Rican Government, the Rector of the University of Costa Rica and four ad-hoc elected representatives, selected on the basis of their experience and knowledge of the area. (Table N°9).

Under this new legal structure, the Center completely revised its Program. Special help for the countries of the Central American Isthmus and of the Antilles is one of the fundamental objectives for future action.

A basic development problem is the difficulty of getting research results to the farmers. The fact that the objectives of CATIE's activities are aimed at a limited geographical region, comprised of small countries with similar agricultural production and land tenure structures, has the Center in a unique situation for carrying out a cooperative and coordinated action that can have real impact.

Since all these countries have a high percentage of small farmers who are the main food producers, the Research Program of CATIE is oriented towards producing information that can be applied to the conditions of the small farmers.

This approach is important because the small farmer in the American Tropics lives and is raised in an environment with many limitations to which researchers are not subjected, and whose decisions are governed by very different principles.

In reality, very few persons understand and comprehend the restrictions confronting the farmer's activities in the field, and few recognize the farmer's ingenuity, which at times helps him to resolve the problems he encounters.

#### d. DESCRIPTION OF THE RESEARCH PROGRAMS

The Center's Program is oriented towards the study of agricultural production systems; the three Basic Programs have the same objective. Thus, since the restructuring of the Center, the Tropical Crops and Soils Program has been concentrating on the development of an "Agricultural Crop Production System Project". In its first phase, an experiment was set up to study a wide range of systems (54), based on five crops grown in the Central American

area: beans, corn, rice, cassava and sweet potato. The systems being studied include not only single crops, but combinations of two, three, four and five crops, at different degrees of association and at different levels of technology, which range from that used by the small farmer, up to the application of the maximum technology known.

A report is given as Appendix 2 on the results obtained in the first year; although it's still not complete, it does indicate some possibilities of the enormous potential value.

In the table summary in this appendix, it may be noted that some associations have production indices of more than 200 per cent as compared with monocultures utilizing high level technology. In some cases, the results are incomplete, as the harvest yields of one crop have still to be added.

Another evident factor is the efficient utilization of labor and fertilizers. In synthesis, the results of the first year --although still preliminary-- indicate the far-reaching possibilities of helping the small farmer to improve his present living conditions.

In addition to this centrally located experiment in CATIE, others having simpler designs were established in different areas of Costa Rica, utilizing the crops of each area. The first information will soon be made available.

- The Tropical Animal Husbandry Program is dedicated to the study of milk and meat production systems; since it has been operating for several years with this orientation, it already has results of great value. Appendix 3 contains more details on this Program and the results obtained, some of which may be summarized as follows:

- 1) It is possible to produce meat and milk in the tropics, with mixed systems, that can produce as much as 800 kilograms of meat, and more than 10,000 liters of milk per hectare.
- 2) These results can be obtained through the intensive use and management of improved pastures.
- 3) The required supplements are mainly energetic, and are based on the use of by-products having little economic value, such as molasses, the residues from harvesting bananas, cacao shells, coffee pulp, etc.
- 4) Those systems can make use of the biomass that multiple cropping systems produce, which is not suitable for human consumption.

The results referred to favor mostly the intermediate property holdings, as they are intensively exploited, although the results can also be of value for small holdings and even for large holdings. It appears therefore that the possibility exists in the lowland tropics to produce these food crops under competitive conditions with the temperate zone countries, and with the tropical highlands.

- The Natural Resources Program is complementary to the others, and is based on the fact that conservation of forest natural resources is essential to guarantee the maintenance of a prosperous agriculture. The natural forest can and should be exploited, but in a rational manner, applying systems which permit the indefinite maintenance of this natural resource, increasing its value by the incorporation of valuable species.

This Program has also produced results of considerable potential interest as shown in Appendix N°4.

A summary of these results to indicate their scope, is given below:

- 1) The rational exploitation of a secondary forest on the Center's campus has resulted in the reduction of the number of original species from 85 to just 17, all of important commercial value.
- 2) Studies on some pests, such as the Meliaceae shootborer (Hypsipyla grandella Zeller), which is impeding the regeneration of valuable species, such as mahogany and cedar --logically implying their prompt extinction-- are producing results that make it possible to foresee the probability of an efficient economic control by means of systemic insecticides, applied once to the tree roots.
- 3) The introduction of rapidly growing species is opening up the possibility of developing a forestry complement to the agricultural industry, since some of these species grown on the farms' forest lands can produce usable timber within five years.
- 4) The Center's Forest Products Laboratory has studied more than 300 native species from these countries, and has found economic uses for many of them, by using some special treatments. With these results, more rational policies for the utilization of the natural forest is possible.

Thus, it can be seen that the three Programs have a realistic approach and already important results have been obtained for the agricultural



development of these countries. This circumstance enables the Center to project its action to the countries in a truly positive manner.

Although the training aspect will be covered in a separate chapter, it is worth mentioning here that the Center participates in a Graduate Program which has been functioning for over thirty years. The Research Programs provide significant support to the training program, facilitating the preparation of specialists at the M.S. level, capable of assuming leadership responsibilities in research, training and development programs within their countries.

e. CATIE'S RESOURCES AND FACILITIES

The Center has a basic staff of 16 highly qualified professionals, the majority with Ph.D. degrees. Several of them were students at the Center, where they received their Magister Scientiae degree, pursuing further studies in universities mainly in North America. (Table N°10).

The physical plant covers an area of approximately 1,000 hectares, located near the city of Turrialba. There are several buildings on the campus: the main building, the building housing the Department of Tropical Crops and Soils, and the building in final stages of construction for the Tropical Animal Husbandry Department. There are a number of greenhouses, well-equipped laboratories, two student dormitories, and 50 residences. (Table N°8).

IICA has its Electronic Computation Unit, located at CATIE, which is well utilized by the Center's Research Program.

The library, although belonging to IICA, also has its location at CATIE as per Agreement with the Costa Rican Government. This library is one of the best of its kind in Latin America and is carrying out an extensive

communications program, publishing bibliographies and two journals: Turrialba and Desarrollo Rural en las Américas (Rural Development in the Americas). At the same time it offers a training program for librarians.

**f. CATIE'S ACTIVITIES WITHIN THE COUNTRIES OF THE AREA**

The Center participates actively in programs operating in the area.

It has cooperated with the Regional Offices of IICA in organizing and developing short courses, national seminars, and has provided technical advisory services, etc. Under the terms of an Agreement with the Panamanian Government, CATIE is providing technical assistance in the development of programs in cacao production and animal husbandry. The Center also has an Agreement with the University of Costa Rica relative to graduate training; and with the Agency for International Development (AID) for teaching Animal Science at the University.

With the Costa Rican Ministry of Agriculture and Animal Husbandry (MAG), CATIE is conducting several experiments at different experimental stations. Together with IICA, the Center is cooperating with the Honduran Government in planning and structuring its research programs; in Nicaragua and El Salvador it has carried out some trials on agricultural systems. In the Antilles it has collaborated with and given technical assistance to the Governments of Haiti and the Dominican Republic.

CATIE has made its action felt in the countries within the area -- more in some than in others. The Center's purpose is to eventually coordinate the support action provided to national institutions by means of cooperative programs and personnel training. The cooperative work with these countries appears in detail in Appendixes 2, 3 and 4.

At the last meeting of the Ministers of Agriculture of the Central American Isthmus held recently in San José, Costa Rica, a motion was passed whereby CATIE was designated to coordinate research activities at the regional level. They also agreed that CATIE should have budgetary support to carry out its task, and for this purpose, they are disposed to support any request for financing that CATIE makes to any international organization.

g. BASIS FOR PROPOSED SUPPORT OF CATIE'S CORE RESEARCH BUDGET

As explained above, CATIE is carrying out a Program of particular interest to the agricultural development of the countries in the Central American area, and also to the tropics in general. The Center has a highly qualified technical staff and the necessary physical facilities, for enabling it to receive substantial support which would allow it to expand and intensify its activities without having to resort to constructing new buildings.

Because of its geographical location in Central America, it is especially prepared to support technically the agricultural development of a group of small countries, having similar agricultural production characteristics and structure. Because of their size, none of these countries could expect to have institutions sufficiently strong and capable of supporting really effective development programs. CATIE therefore is in a singularly favorable condition to carry out a Program of real impact.

CATIE's Program dedicated to the study of agricultural systems is amply justified, since it is directly related to the solution of the basic agricultural problem of those countries. Nonetheless, it would not be reasonable for CATIE's Program to be aimed only at improving some essential food crops, since several of the international institutions are already directing some of their resources towards this objective, and with their technical

know-how are already developing improved plant material of the major food crops. This in turn can be used to better advantage by means of a selection and adaptation process, utilizing advanced generations of genetic material.

CATIE's Program complements the work being conducted by international institutions and can help solve the problem of transferring and utilizing research results, adapting them to the different ecological situations and in accordance with the social conditions of the farmer to benefit from them.

CATIE urgently needs the support it is requesting, in order to consolidate its Program and give it the efficient projection it demands.

The proposal for financial support presented contemplates assistance that will reinforce its Program from the first year, since it considers the inclusion of six specialists. (Table N°1). Thus for example, the Tropical Crops and Soils Program has assigned top priority to a Production Specialist and to one in Weed Control. Multiple or associated cropping systems present certain specific problems, which must be studied thoroughly. Some associations can reduce input. This is also true for weeds, one of the big problems in raising crops in the tropics. Methods must be sought to reduce the use of chemical herbicides; this would signify not only a considerable reduction of input and the danger that their application can cause, but would also provide for a better utilization of the soil, eliminating weeds through the use of associations, contributing in this manner to an effective weed control.

In the Tropical Animal Husbandry Department, first priority has been given to add a veterinarian to the technical staff. More than a clinical veterinarian, a professional is needed with a feeling for ecology to work in the Program on disease prevention, seeking favorable ecological environments,

rather than working on individual animal diagnoses.

The Natural Resources Program has as top priority a Woods Technology Specialist to work with the Center's Forest Products Laboratory, which is doing outstanding work. His services are needed by and are even paid for in part by the different countries. The studies on and the characteristics of the natural forest woods are making a highly significant contribution to a better utilization of the forest. At present this Laboratory is functioning under the direction of experts, but without the supervision of a high level specialist capable of programming original research activities.

A new program has also been added into the proposal as support to the other Programs, rather than for specific research per se.

All the Center's emphasis is directed towards the study of agricultural production systems that combine annual and perennial crops, and forest trees with animals. Each system has to be based on solid economic principles that represent an obvious advantage to the farmer.

With this objective in mind, during the first year, a first priority was established for a Systems Analyst and an Economist, to serve in a support capacity for the whole Center's Research Program. The systems being studied in the three Programs are accumulating a mass of information that are not being adequately analyzed at present.

In this way, an analyst, using the computer facilities that exist at the Center, could analyze the mass of biological, physical, climatological and economic information available as pertaining to the production process. With all this data he would be able to conduct an appropriate analysis of the systems in order to be able to select among them new alternatives to be adjusted to small farmer conditions.

An Economist, on his part, could evaluate the utility of the systems actually used by the farmers, and compare them economically with those recommended by researchers. The mass of basic data that is being compiled, covering all the required production inputs, would permit pertinent economic analyses to be made prior to making recommendations to the farmers on the adopting of any particular system.

Within the projection, it is proposed later to add an Ecologist and a Sociologist-Extension Specialist. In Appendix N°5 the specific functions of each Specialist are given.

The Proposal for the 1975/1976 fiscal period comes to a total of US\$600,000. Table N°1 specifies the diverse fields that need support. In this Table, the four Programs appear, each with three columns; the first corresponding to the support CATIE will provide from its own budget, the second indicates the external support that is being requested, and the third lists 'Other Financial Sources'.

Table N°2 includes the total budget that CATIE would obtain with the requested outside support. Each Program appears in two columns; one shows CATIE's contribution; and the other shows the external assistance needed.

Table N°3 shows the distribution of the US\$600,000 among the four Programs, indicating the sum destined to support the existing Technical Units and the amount needed to finance new Technical Units. Table N°4 summarizes CATIE's contribution and the solicited support by Programs and expenditure item.

These calculations are based on the fact that CATIE is actually

suffering from a real budgetary crisis and that the level of activities that is being carried out is possible only with the sacrifice and self-denial of all personnel, who are actively collaborating with a profound faith in the importance of their work, and in the hope that the situation will change, especially in view of the urgent need to have programs such as those of the Center, which can contribute significantly to the solution of the world's hunger problem.

The idea was put forth, that it is essential to arrive at a rational cost for a Technical Unit. The details of the cost of each Technical Unit for each of the Programs are shown in Table N°5. In the budget presented for the 1975/1976 fiscal year, the cost of the Technical Unit is US\$54,000. In the 5-year projection, the idea is to raise this value gradually to approach what is considered an ideal cost of US\$60,000.

Three specialists whose services are made available by 'Outside Funds', are included in the budget. Unfortunately, this support provides only the specialists' salaries, and it is necessary to provide them with operational expenses.

In any case, this support is valuable and contributes within the general context of the cost per Technical Unit (US\$54,000) and to the reinforcement of the Program.

#### h. FIVE-YEAR PROJECTION

The projection presented in Table N°5 has not been studied in detail, since it is necessary to maintain a flexible criterion that permits the adaptation or re-orientation of given objectives, according to what the research programs and the needs of the countries indicate, and the problems that can

occur as a result of economic inflation.

The total number of technical staff will reach 33 specialists within a five-year period; three of these will be paid for by 'Outside Funds'.

Some governments, such as those of the United Kingdom, the Netherlands, Canada and the Federal German Republic, have shown interest in contributing to the Center; this collaboration at this moment consists in assigning Specialists in specified fields, with only their salaries paid. The Center has been obliged to limit the acceptance of this type of assistance, covering only the operational costs of said specialists, excluding housing, since this is handled under a self-financing system whereby all personnel pay a house rental fee.

The projection also takes into account the gradual decrease of IICA support, whereby the US\$516,000 included in the fiscal year 1975/1976 will be reduced over a period to US\$300,000 annually, as per the contractual agreement on this matter.

Since the proposed request is specifically for the year 1975/1976, the projection for the following four years should be considered only as an approximation it is understood that future support will be given on the basis of the success obtained by the Program's development and according to the real needs that are felt over the years.

As additional information, Table N°6 in this same section lists all the 'Resources' that CATIE has; Table N°8 lists an 'Inventory of Landed & Chattel Property Assets'. These illustrate the economic support that CATIE has with all its resources.



1. PROPOSED SUPPORT FOR CATIE'S TRAINING PROGRAM

Ever since the creation of the Inter-American Institute of Agricultural Sciences of the OAS (IICA), this Center has been operating a Graduate School. It has the honor of having been the first School of its kind in Latin America, and has graduated to date approximately 600 professionals, with the Magister Agriculturae degree in the early years, and latterly the Magister Scientiae degree.

When IICA moved its main administrative offices to San José, Costa Rica, and extended its action throughout all of Latin America, the Center remained as a Support Program, until 1973, when CATIE was transformed, acquiring a new structure as a civil association, under the Agreement subscribed to by IICA and the Costa Rican Government. This Agreement was complemented by another signed with the University of Costa Rica, making the latter responsible academically for the courses that the School offers and for awarding of the corresponding degree.

Since the School is of international character and admits students from all the American countries, the University of Costa Rica --which is a national institution-- is unable to contribute economically to its maintenance.

All of the budget involving the School's financing is paid for by CATIE.

Upon re-orienting its Research Program, CATIE assigned top priority to this activity. One of the main objectives of changing this policy was to assure a solid technical basis for training. At that time, the students began to form part of the Research Programs, and their thesis projects are an integral part of the Programs.

This change in emphasis ensures the training of a specialist with a scientific basis combined with technical ability as well as a researcher capable of assuming leadership in his own country in research, training and development programs. With this system, it was hoped to create leadership nuclei in each country qualified to cooperate --under equal conditions-- with foreign specialists, in the technical assistance programs. The limited impact of this type of assistance is due mainly to the fact that when foreign specialists are assigned to a given country, they are faced with the situation that there is no competent counterpart available that can help them study the problems objectively, and within the framework imposed by the individual circumstances of that country.

Under CATIE's new structure, the School has to orient its efforts to giving top priority to the training of professionals in the countries within the region. This implies a problem with a difficult solution. Up to the present, the students coming from this area have been in the minority, mainly because there are few professional schools having an adequate level in these countries, and candidates for graduate studies should possess a satisfactory basic preparation, to enable them to assimilate the training programs without difficulty.

However, the School's level cannot be lowered to accommodate students without sufficient preparation. The best solution would seem to be to select candidates on the basis of their intellectual capacity and according to their interest in certain areas and make available to them the academic and economic means, and the time needed to take preparatory and make-up courses. In effect, the University of Costa Rica is especially prepared to cooperate in this process of offering preparatory courses.

The support that the Center needs is essentially to carry out this Program. The School should be under the leadership of a Director, who can dedicate full time to the position. These duties have been carried out by CATIE personnel, and after the establishment of the Agreement with the University of Costa Rica, by one of its Professors. Both persons have done this work in addition to their regular activities; this logically has made it inoperable, especially if the School is being oriented to be of particular service to students from the area.

It is not easy to estimate the operational cost of training at CATIE, it being so closely related to research work.

Each one of CATIE's Specialists, and even the Resident Scientists, are obliged to give courses and to serve as student Advisors. If each Specialist gives 25 per cent of his time to training purposes, and each student thesis costs the Center a sum that fluctuates from US\$500 --in Programs in Tropical Crops & Soils, and Natural Resources-- to more than US\$1,000 in the Animal Husbandry Program; the average cost per thesis would be around US\$700. Thus, CATIE's financial participation in the maintenance of the School could be estimated accordingly:

25% of the Cost of Professional personnel	
as well as Resident Scientists .....	US\$118,750
Cost of 35 theses annually .....	24,500
Registrar's Office Costs .....	<u>20,000</u>
T O T A L	US\$163,250

All the students enter the Center on scholarships. The Netherlands Government at present is giving 15 scholarships, and the Federal German Republic 6; in addition to those given by the different IICA Regional Offices,

the Food and Agriculture Organization of the United Nations (FAO), the Organization of American States (OAS), and the respective governments.

The annual amount of scholarships is estimated to be US\$220,000.

In calculating the scholarships, US\$400 are earmarked for registration fees. The money accumulated from this item is used entirely for 'Special Training Expenses', and is used to cover certain costs of the University of Costa Rica Professors.

### Support Actions

In order to give training the orientation needed to help the countries in the area, several complementary actions are required in addition to those the School is actually carrying out, as indicated below:

- 1) Recruit candidates through personal interviews in their home countries. For this, special forms are being prepared which will permit the evaluation of the intellectual capacity and the candidates' interest, besides their academic background.
- 2) Provide specific and complementary scholarships, so that the postulants may take basic courses in the University of Costa Rica.
- 3) Make funds available that guarantee the payment of fees, per diem, and travel expenses between San José and Turrialba, for University of Costa Rica Professors who give courses in the Graduate School.
- 4) To provide the services of a Coordinator who would direct the School, personally carry out recruitment and be responsible

for preparing the curriculum, in close collaboration with  
the Curriculum Committee.

A summary of the different items, for which financing is needed, is  
given below:

Proposed Additional Financing for the Graduate Program

Coordinator - Professor	US\$26,200
Student Recruitment Travel	5,000
Complementary Scholarships for Basic Studies	34,000
Transportation for University of Costa Rica Professors	5,000
Per Diem for University of Costa Rica Professors	3,000
Extra wages and part time salaries for University of Costa Rica Professors, and for those from other institutions	15,000
Teaching Materials	5,000
Equipment	3,800
Purchase of Books for the Library	<u>3,000</u>
T O T A L	US\$100,000

The above mentioned sums correspond to the first year's expenses.  
The projection for four years would only include the doubling of the 'Scholar-  
ship' item, since the study period --on the average-- is more than a year,  
and depends on the special situation of each student. This would mean that  
the budget from the second year would ascend to US\$134,000.

TABLE N°1

PROFESSIONAL STAFF -- 1975 - 1976

	Financial Source		
	CATIE's Basic Budget	External Support	Other Sources
<b>1. <u>TROPICAL CROPS &amp; SOILS</u></b>			
Agronomist - Crops	1		
Crop Management Specialist	1		
Weed Control Specialist		1	
Soil Fertility Specialist	1		
Soil Physicist	1		
Plant Breeder	1		
Plant Pathologist	1		
Plant Physiologist	1		
Production Specialist		1	
Entomologist			1
<b>2. <u>TROPICAL ANIMAL HUSBANDRY</u></b>			
Nutritionist - By-products	1		
Nutritionist - Systems Integration	1		
Animal Breeder - Meat Production	1		
Animal Breeder - Milk Production	1		
Agrostologist	1		
Veterinarian		1	
<b>3. <u>NATURAL RESOURCES</u></b>			
Silviculturist	1		
Forester, Silviculture	1		
Forester, Forest Management	1		
Watershed Management Specialist	1		
Wood Technologist		1	
Forest Entomologist			1
Specialist in Fire Control			1
<b>4. <u>TECHNICAL SUPPORT</u></b>			
Systems Analyst		1	
Economist		1	
<b>TOTAL</b>	<b>16</b>	<b>6</b>	<b>3</b>

TABLE No 2

BUDGET ANALYSIS -- 1975 - 1976

(IN US\$)

A c c o u n t s	Tropical Crops and Soils		Tropical Animal Husbandry		Natural Resources		Technical Support		T o t a l		GRAND TOTAL	%
	CATIE	External Support	CATIE	External Support	CATIE	External Support	CATIE	External Support	CATIE	External Support		
<b>PERSONNEL COSTS</b>												
Professional Staff	183,400	52,400	131,000	26,200	104,800	26,200	52,400		419,200	157,200	576,400	
Auxiliary Staff:												
Secretaries	13,482	10,592	11,000	4,500	9,000	3,500	6,000		33,482	24,592	58,074	
Laboratory and Field Assistants	18,865	8,440	5,270	12,730	9,138	7,062	6,000		33,273	34,232	67,505	
<b>T o t a l</b>	<b>215,747</b>	<b>71,432</b>	<b>147,270</b>	<b>43,430</b>	<b>122,938</b>	<b>36,762</b>	<b>64,400</b>		<b>485,955</b>	<b>216,024</b>	<b>701,979</b>	<b>56.4</b>
<b>OPERATIONAL COSTS</b>												
Labor	17,500	15,000	7,176	16,825	19,500		3,000		24,676	54,325	79,001	
Travel	2,007	21,300	1,250	9,515	7,000		4,000		3,257	41,815	45,072	
Vehicles (Motor Pool)	3,850	4,600	1,500	2,800	6,000		4,000		6,350	17,400	23,750	
Publications		9,080		3,000	6,500		4,000			22,580	22,580	
Equipment		16,000		13,000	10,000		8,000			47,000	47,000	
Field and Laboratory Supplies	6,650	22,000	6,000	20,500	7,000		4,000		12,650	53,500	66,150	
Supplies and Services	7,070	15,920	1,750	3,500	5,238		5,000		9,620	29,658	39,278	
Maintenance	3,892	9,348	1,000	3,750	2,000		1,600		4,892	16,698	21,590	
<b>T o t a l</b>	<b>40,969</b>	<b>113,248</b>	<b>18,676</b>	<b>72,890</b>	<b>1,800</b>	<b>63,238</b>	<b>33,600</b>		<b>61,445</b>	<b>282,976</b>	<b>344,421</b>	<b>27.7</b>
<b>LIBRARY SERVICES</b>												
Library		3,000		2,000		2,000	4,000			11,000	11,000	
<b>T o t a l</b>		<b>3,000</b>		<b>2,000</b>		<b>2,000</b>	<b>4,000</b>			<b>11,000</b>	<b>11,000</b>	<b>0.9</b>
<b>ADMINISTRATIVE EXPENSES</b>												
Director's Office; Administration and General Services	45,304	33,120	29,284	20,880	22,012	18,000	18,000		96,600	90,000	186,600	
<b>T o t a l</b>	<b>45,304</b>	<b>33,120</b>	<b>29,284</b>	<b>20,880</b>	<b>22,012</b>	<b>18,000</b>	<b>18,000</b>		<b>96,600</b>	<b>90,000</b>	<b>186,600</b>	<b>15.0</b>
<b>GRAND TOTAL</b>	<b>302,020</b>	<b>220,800</b>	<b>195,230</b>	<b>139,200</b>	<b>146,750</b>	<b>120,000</b>	<b>120,000</b>		<b>644,000</b>	<b>600,000</b>	<b>1,244,000</b>	<b>100.0</b>
<b>%</b>	<b>24.3</b>	<b>17.7</b>	<b>15.7</b>	<b>11.2</b>	<b>11.7</b>	<b>9.7</b>	<b>9.7</b>		<b>51.8</b>	<b>48.2</b>		

BUDGET ANALYSIS -- 1975 - 1976  
(IN US\$)

Accounts	Tropical Crops and Soils		Tropical Animal Husbandry		Natural Resources		Technical Support		Total		GRAND TOTAL %
	CATIE	External Support	CATIE	External Support	CATIE	External Support	CATIE	External Support	CATIE	External Support	
<b>1. PERSONNEL COSTS</b>											
Professional Staff	183,400	52,400	131,000	26,200	104,800	26,200	52,400		419,200	157,200	576,400
Auxiliary Staff Secretaries	13,482	10,592	11,000	4,500	9,000	3,500	6,000		33,482	24,592	58,074
Laboratory and Field Assistants	18,865	8,440	5,270	12,730	9,138	7,062	6,000		33,273	34,232	67,505
<b>Total</b>	<b>215,747</b>	<b>71,432</b>	<b>147,270</b>	<b>43,430</b>	<b>122,938</b>	<b>36,762</b>	<b>64,400</b>		<b>485,955</b>	<b>216,024</b>	<b>701,979</b>
<b>2. OPERATIONAL COSTS</b>											
Labor	17,500	15,000	7,176	16,825	19,500		3,000		24,676	54,325	79,001
Travel	2,007	21,300	1,250	9,515	7,000		4,000		3,257	41,815	45,072
Vehicles (Motor Pool)	3,850	4,600	1,500	2,800	6,000		4,000		6,350	17,400	23,750
Publications		9,080		3,000	6,500		4,000			22,580	22,580
Equipment		16,000		13,000	10,000		8,000			47,000	47,000
Field and Laboratory Supplies	6,650	22,000	6,000	20,500	7,000		4,000		12,650	53,500	66,150
Supplies and Services	7,070	15,920	1,750	3,500	5,238		5,000		9,620	29,658	39,278
Maintenance	3,892	9,348	1,000	3,750	2,000		1,600		4,892	16,698	21,590
<b>Total</b>	<b>40,969</b>	<b>113,248</b>	<b>18,676</b>	<b>72,890</b>	<b>1,800</b>	<b>63,238</b>	<b>33,600</b>		<b>61,445</b>	<b>282,976</b>	<b>344,421</b>
<b>3. LIBRARY SERVICES</b>											
Library		3,000		2,000	2,000		4,000			11,000	11,000
<b>Total</b>		<b>3,000</b>		<b>2,000</b>	<b>2,000</b>		<b>4,000</b>			<b>11,000</b>	<b>11,000</b>
<b>4. ADMINISTRATIVE EXPENSES</b>											
Director's Office: Administration and General Services	45,304	33,120	29,284	20,880	22,012	18,000	18,000		96,600	90,000	186,600
<b>Total</b>	<b>45,304</b>	<b>33,120</b>	<b>29,284</b>	<b>20,880</b>	<b>22,012</b>	<b>18,000</b>	<b>18,000</b>		<b>96,600</b>	<b>90,000</b>	<b>186,600</b>
<b>GRAND TOTAL</b>	<b>302,020</b>	<b>220,800</b>	<b>195,230</b>	<b>139,200</b>	<b>146,750</b>	<b>120,000</b>	<b>120,000</b>		<b>644,000</b>	<b>600,000</b>	<b>1,244,000</b>
<b>%</b>	<b>24.3</b>	<b>17.7</b>	<b>15.7</b>	<b>11.2</b>	<b>11.7</b>	<b>9.7</b>	<b>9.7</b>		<b>51.8</b>	<b>48.2</b>	<b>100.0</b>



TABLE N°3

BUDGET DISTRIBUTION OF REQUESTED EXTERNAL SUPPORT

BY PROGRAMS AND BY EXPENDITURE ITEMS

(in US\$)

	<u>Support for Existing Units</u>	<u>New Units</u>	<u>T o t a l</u>	<u>%</u>
<b>1. <u>TROPICAL CROPS &amp; SOILS</u></b>				
Personnel Costs	7,032	64,400	71,432	
Operational Costs	76,248	37,000	113,248	
Library Services	2,400	600	3,000	
Administrative Expenses	<u>15,120</u>	<u>18,000</u>	<u>33,120</u>	
<b>T o t a l</b>	<u>100,800</u>	<u>120,000</u>	<u>220,800</u>	<b>36.8</b>
<b>2. <u>TROPICAL ANIMAL HUSBANDRY</u></b>				
Personnel Costs	11,230	32,200	43,430	
Operational Costs	54,390	18,500	72,890	
Library Services	1,700	300	2,000	
Administrative Expenses	<u>11,880</u>	<u>9,000</u>	<u>20,880</u>	
<b>T o t a l</b>	<u>79,200</u>	<u>60,000</u>	<u>139,200</u>	<b>23.2</b>
<b>3. <u>NATURAL RESOURCES</u></b>				
Personnel Costs	10,562	26,200	36,762	
Operational Costs	63,238		63,238	
Library Services	2,000		2,000	
Administrative Expenses	<u>13,377</u>	<u>4,623</u>	<u>18,000</u>	
<b>T o t a l</b>	<u>89,177</u>	<u>30,823</u>	<u>120,000</u>	<b>20.0</b>
<b>4. <u>TECHNICAL SUPPORT</u></b>				
Personnel Costs		64,400	64,400	
Operational Costs		33,600	33,600	
Library Services		4,000	4,000	
Administrative Expenses		<u>18,000</u>	<u>18,000</u>	
<b>T o t a l</b>		<u>120,000</u>	<u>120,000</u>	<b>20.0</b>
<b>G R A N D T O T A L</b>	<b>269,177</b>	<b>330,823</b>	<b>600,000</b>	
<b>%</b>	<b>44.9</b>	<b>55.1</b>	<b>100.0</b>	

(TABLE N°3 CONTINUED)

<u>SUMMARY OF PREVIOUS BUDGETARY DISTRIBUTION, FOR THE CENTER</u>	<u>Support for Existing Units</u>	<u>New Units</u>	<u>Total</u>	<u>%</u>
Personnel-Costs	28,824	187,200	216,024	36.0
Operational Costs	193,876	89,100	282,976	47.2
Library Services	6,100	4,900	11,000	1.8
Administrative Expenses	<u>40,377</u>	<u>49,623</u>	<u>90,000</u>	<u>15.0</u>
<b>T O T A L</b>	<b><u>269,177</u></b>	<b><u>330,823</u></b>	<b><u>600,000</u></b>	<b><u>100.0</u></b>

TABLE N°4

GENERAL BUDGET SUMMARY - BY PROGRAMS AND BY EXPENDITURE ITEMS

	(in US\$)			
	<u>CATIE</u>	<u>External Support</u>	<u>Total</u>	<u>%</u>
<b>1. <u>TROPICAL CROPS &amp; SOILS</u></b>				
Personnel Costs	215,747	71,432	287,179	
Operational Costs	40,969	113,248	154,217	
Library Services		3,000	3,000	
Administrative Costs	<u>45,304</u>	<u>33,120</u>	<u>78,424</u>	
<b>T o t a l</b>	<u>302,020</u>	<u>220,800</u>	<u>522,820</u>	<b>42.0</b>
<b>2. <u>TROPICAL ANIMAL HUSBANDRY</u></b>				
Personnel Costs	147,270	43,430	190,700	
Operational Costs	18,676	72,890	91,566	
Library Services		2,000	2,000	
Administrative Costs	<u>29,284</u>	<u>20,880</u>	<u>50,164</u>	
<b>T o t a l</b>	<u>195,230</u>	<u>139,200</u>	<u>334,430</u>	<b>26.9</b>
<b>3. <u>NATURAL RESOURCES</u></b>				
Personnel Costs	122,938	36,762	159,700	
Operational Costs	1,800	63,238	65,038	
Library Services		2,000	2,000	
Administrative Costs	<u>22,012</u>	<u>18,000</u>	<u>40,012</u>	
<b>T o t a l</b>	<u>146,750</u>	<u>120,000</u>	<u>266,750</u>	<b>21.4</b>
<b>4. <u>TECHNICAL SUPPORT</u></b>				
Personnel Costs		64,400	64,400	
Operational Costs		33,600	33,600	
Library Services		4,000	4,000	
Administrative Costs		<u>18,000</u>	<u>18,000</u>	
<b>T o t a l</b>		<u>120,000</u>	<u>120,000</u>	<b>9.7</b>
<b>GRAND TOTAL</b>	<b>644,000</b>	<b>600,000</b>	<b>1,244,000</b>	
<b>%</b>	<b>51.8</b>	<b>48.2</b>		<b>100.0</b>

**ITEMIZED SUMMARY, FOR THE CENTER:**

Personnel Costs	485,955	216,024	701,979	56.4
Operational Costs	61,445	282,976	344,421	27.7
Library Services		11,000	11,000	0.9
Administrative Costs	<u>96,600</u>	<u>90,000</u>	<u>186,600</u>	15.0

TABLE N°5

P R O J E C T I O N F O R T H E P E R I O D 1 9 7 5 - 1 9 8 0  
(in US\$)

Period	Origin of Resources	Tropical Crops and Soils	Tropical Animal Husbandry	Natural Resources	Technical Support	Total	Average Cost Technical Unit Year*
1975/76	CATIE	302,020	195,230	146,750		644,000	
	External Support	220,800	139,200	120,000	120,000	600,000	
	T o t a l	522,820	334,430	266,750	120,000	1,244,000	
	Technical Units/Year	10	6	7	2	25	54.568
1976/77	CATIE	265,680	165,320	127,000		558,000	
	External Support	285,200	179,800	155,000	180,000	800,000	
	T o t a l	550,880	345,120	282,000	180,000	1,358,000	
	Technical Units/Year	11	6	7	3	27	54.748
1977/78	CATIE	229,340	142,410	107,250		479,000	
	External Support	395,600	249,400	215,000	240,000	1,100,000	
	T o t a l	624,940	391,810	322,250	240,000	1,579,000	
	Technical Units/Year	11.5	7	7	4	29.5	57.600
1978/79	CATIE	193,000	119,500	87,500		400,000	
	External Support	533,600	336,400	290,000	240,000	1,400,000	
	T o t a l	726,600	455,900	377,500	240,000	1,800,000	
	Technical Units/Year	14	8	7	4	33	58.188
1979/80	CATIE	193,000	119,500	87,500		400,000	
	External Support	533,600	336,400	290,000	240,000	1,400,000	
	T o t a l	726,600	455,900	377,500	240,000	1,800,000	
	Technical Units/Year	14	8	7	4	33	58.188

\* In order to determine the average annual cost of each Technical Unit, the sum of US\$120,200 (Other Financial Sources) was taken into account, as explained in Table N°6

TABLE N°6

CATIE'S BUDGET RESOURCES -- 1975 - 1976

(in US\$)

		<u>Contributions</u>
<b>1. <u>BASIC BUDGET</u> (not restricted)</b>		
IICA Quota	537,000	
Costa Rican Government Quota	50,000	
Profit from Commercial Operations	47,000	
Agreement with the Ministry of Agricultural Development, Panama	<u>10,000</u>	644,000*
<b>2. <u>OTHER FINANCIAL RESOURCES</u> (restricted)</b>		
a) Forest Products Laboratory	45,200	
Government of the United Kingdom	50,000	
Food & Agriculture Organization of the United Nations (FAO)	<u>25,000</u>	120,200**
b) United States Atomic Energy Commission (USAEC)		75,000***
c) Scholarships from Various Donors		<u>220,000</u>
<b>T O T A L</b>		<b>1,059,200</b>

\* CATIE has used this sum, without restrictions, for calculating its budget.

\*\* This amount has been used for determining the cost of the Technical Unit/year. The US\$45,200 are for the exclusive use of the Forest Products Laboratory, according to the Agreement between the Costa Rican Ministry of Agriculture and Animal Husbandry, the University of Costa Rica and CATIE. The remaining US\$75,000 represent the estimated cost of the salaries of three specialists assigned to the Center: two by the Government of the United Kingdom, and one by FAO.

\*\*\* This sum is totally restricted, to be used specifically for the contract between the USAEC and this Center.

TABLE N°7

BALANCE SHEET

-- to June 30, 1974 --

(in US\$)

ASSETS

Current Assets:

Cash and Bank Accounts 120,873

Accounts Due:

a) Students 3,872

b) Employees 575

c) Others 119,782 124,229

Inventories:

a) Coffee in Warehouses (for export) 43,022

b) Materials and Supplies 64,473 107,495

Total of Current Assets 352,597

Other Assets:

Prepaid Charges 309

Redeemable Investments 53,106

Total of Other Assets 53,408

TOTAL ASSETS 406,005

LIABILITIES

Current Liabilities:

Accounts Payable 27,943

Other Funds 48,677

Revolving Fund 16,475

Reserves and Provisions 98,561

Total Liabilities 191,656

CAPITAL

Working Fund 164,349

Costa Rican Government Quota (1973-1974) 50,000

Total Capital 214,349

TOTAL LIABILITIES & CAPITAL 406,005

TABLE N°8

INVENTORY OF LANDED & CHATTEL PROPERTY ASSETS

-- to June 30, 1974 --

(in US\$)

1. <u>Land:</u>		1,839,600
1,000 hectares in Turrialba	1,800,000	
99 hectares in La Lola	<u>39,600</u>	
2. <u>Buildings:</u>		1,049,000
Main Administration Building	500,000	
Animal Husbandry Building	135,000	
Tropical Crops & Soils Building	250,000	
Natural Resources Laboratory	5,000	
Computation & Statistics Building	5,000	
Student Dormitories	33,000	
Club and Swimming Pool	52,000	
Primary School and Kindergarten	10,000	
Creamery and Milking Installations	10,000	
Various - Turrialba	28,000	
Various - La Lola	<u>21,000</u>	
3. Greenhouses		10,000
4. Warehouses, Garages, Shops, Service Station		35,000
5. Electrical, Telephone, Water Installations		123,000
6. Residences		400,000
7. Vehicles		82,900
8. Machinery		59,200
9. Laboratory Equipment		140,000
10. Furniture and General Equipment		151,600
11. Animal Stock		<u>250,000</u>
	<b>T O T A L</b>	<b><u>4,140,300</u></b>

Note:

These assets do not appear in the Balance Sheet (Table N°7), as they are not entered in the Accounting books; they do appear in the Center's inventories.

TABLE N°9

MEMBERS OF CATIE'S BOARD OF DIRECTORS

**President\***

A d H o c M e m b e r s

**First Vice-President**

Professor Salvador E. Alemañy  
Dean, Agricultural Sciences  
Recinto Universidad de Mayagüez  
Mayagüez, PUERTO RICO

**Second Vice-President**

Dr. Edwin J. Wellhausen  
Rockefeller Foundation  
Londres 40, Desp. 101  
Mexico 6, D. F., MEXICO

Ing. Eduardo Castillo  
President of Central American  
Agricultural Industries, S.A.  
8a. Calle 2 - 55, Zona 1  
Guatemala, GUATEMALA

Ing. Armando Samper  
President  
National Corporation for Forest  
Research  
Apartado Aéreo 100286  
Bogotá, COLOMBIA

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\* Vacant due to the resignation of Lic. Eugenio Rodríguez Vega, Rector of the University of Costa Rica.



C o s t a R i c a n G o v e r n m e n t R e p r e s e n t a t i v e s

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\* Recently appointed to the position.

TABLE N°10

TROPICAL AGRICULTURAL RESEARCH AND TRAINING CENTER

(CATIE)

PROFESSIONAL STAFF

ALBERTIN, Waldemar, Ph.D. (Germany) .....	Forester, Silviculturist, Head of Natural Resources Program
BAZAN, Rufo, Ph.D. (Bolivia) .....	Soils Scientist
CAMACHO, Edilberto, Mag.Agr. (Costa Rica) .....	Horticulturist
CUBILLOS, Gustavo, Ph.D. (Chile) .....	Agrostologist
DEATON, Oliver, Ph.D. (U.S.A.) .....	Animal Husbandman
ELGUETA, Manuel, Agr. Eng. (Chile) .....	Plant Breeder, Director of CATIE
ERICKSON, Arnold L., M.S. (U.S.A.) .....	Horticulturist - Secretary of Research
FARGAS, José, Ph.D. (Ecuador) .....	Plant Physiologist
FORSYTHE, Warren, Ph.D. (Jamaica) .....	Soils Scientist
FUENTES, Luis Guillermo, Agr. Eng. (Costa Rica) .....	Field Administrator - Animal Husbandry Farm
MATEO, Nicolás, Agr. Eng. (Costa Rica) .....	Agricultural Production Systems Specialist
*MOH, Carl C., Ph.D. (U.S.A.) .....	Cytogeneticist - Head of the Nuclear Energy Program (NEP)
MOJICA, Iván, Ph.D. (Colombia) .....	Forester, Watershed Management Specialist
MORENO, Raúl, Ph.D. (Chile) .....	Plant Pathologist
MUÑOZ, Héctor, Ph.D. (Mexico) .....	Animal Husbandman, Head of the Tropical Ani- mal Husbandry Program

PINCHINAT, Antonio, Ph.D. (Haiti) .....	Geneticist
ROSERO, Pablo, Mag.Agr. (Ecuador) .....	Forester - Forest Management
RUIZ, Manuel E., Ph.D. (Peru) .....	Animal Nutritionist
SORIA, Jorge, Ph.D. (Ecuador) .....	Geneticist, Head of the Tropical Crops and Soils Program
SYLVAIN, Pierre G., Ph.D. (Haiti) .....	Horticulturist - "Emeritus"
VOHNOUT, Karel, Ph.D. (Ecuador) .....	Animal Nutritionist
*WHITE, Rodney C., Ph.D. (U.S.A.) .....	Plant Physiologist
WHITMORE, Jacob, M.For. (U.S.A.) .....	Forester, Silviculturist

**\*\*Resident Scientists:**

HUTCHINS, Lee M., Ph.D. (U.S.A.) .....	Pathologist
LAWRENCE, Jeremy, Ph.D. (United Kingdom) .....	Plant Pathologist
STERRINGA, Jacob, Agr.Eng. (Holland) .....	Silviculturist

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\* Personnel paid by the Contract signed between the United States Atomic Energy Commission and CATIE, for the operation of the Nuclear Energy Program (NEP) within the Tropical Crops and Soils Program.

\*\* Personnel working at this Center, paid by other Organizations.

**PART II**

SOME STATISTICS INDICATING THE AGRICULTURAL SITUATION IN  
THE CENTRAL AMERICAN COUNTRIES

**TABLE N°1**

**PRODUCTION UNITS IN CENTRAL AMERICA**

Country	Conventional Group		Area Ha.	N° of Farms %	Estimates to 1972	
	Farm Size Ha.				Total Area Ha.	Total Number Farms
Guatemala	Small	0-5	14.60	80.33		
	Medium	5-20	14.96	14.61		
	Large	> 20	70.44	5.06		
					<b>3,893,178.7</b>	<b>463,251</b>
El Salvador	Small	0-5	156.4	85.19		
	Medium	5-20	13.67	9.92		
	Large	> 20	70.69	4.89		
					<b>1,878,014.1</b>	<b>251,854</b>
Honduras	Small	0-5	9.79	59.98		
	Medium	5-20	18.40	27.32		
	Large	> 20	71.81	13.70		
					<b>2,735,333.3</b>	<b>197,968</b>
Nicaragua	Small	0-5	3.12	42.60		
	Medium	5-20	5.86	25.88		
	Large	> 20	91.02	32.06		
					<b>4,315,463.6</b>	<b>133,443</b>
Costa Rica	Small	0-5	2.18	45.75		
	Medium	5-20	7.38	24.92		
	Large	> 20	90.44	29.33		
					<b>3,020,068.2</b>	<b>108,549</b>
					<b>15,751,057.9</b>	<b>1,135,085</b>

TABLE N°2

CENTRAL AMERICA: THE RELATIVE IMPORTANCE IN THE COUNTRIES WITH RESPECT TO CERTAIN MAJOR VARIABLES OF THE AGRICULTURAL SECTOR, 1970. (PERCENTAGES)\*

Variables	Guatemala	El Salvador	Honduras	Nicaragua	Costa Rica	Central America
1. Area in farmland	25.8	12.0	16.4	27.0	18.8	100.0
2. Agricultural population	37.7	21.1	18.2	12.7	10.3	100.0
3. Agricultural income	33.2	20.3	15.5	14.5	16.5	100.0
4. Lower class, ** within the agricultural population	42.5	24.6	15.0	9.5	8.4	100.0
5. Agricultural labor force	42.3	24.3	14.6	11.1	7.7	100.0
6. Excess agricultural labor force	41.2	24.7	14.9	11.3	7.9	100.0

\* Taken from:

SIECA. The integrated development of Central America in the present decade. Bases and proposals for improvement and restructuring of the Central American Common Market. Study N°4: Integrated Agricultural Development Program. Guatemala, SIECA, October, 1972. 304 p.

Source: Calculations based on data from GAFICA.

\*\* Laborers without land and small land holders ("minifundio").

**TABLE N°3**

**CENTRAL AMERICA: RELATIONSHIPS AMONG SOME OF THE VARIABLES IN THE  
AGRICULTURAL SECTOR; BY COUNTRIES, 1970. (PERCENTAGES)\***

	Guatemala	El Salvador	Honduras	Nicaragua	Costa Rica	Central America
1. Agricultural Population/total population	62.5	53.8	62.0	55.3	48.9	57.8
2. Lower class/** agricultural population	81.5	84.1	59.4	53.8	59.2	72.3
3. Lower class/total population	50.9	45.2	36.8	11.5	19.0	41.8
4. Labor force/agricultural population	32.3	32.0	30.0	32.8	28.7	31.6
5. Excess labor force/labor force	52.3	58.3	42.5	21.5	14.7	44.4
6. Excess labor force/agricultural population	16.9	18.7	13.0	7.0	4.2	14.0
7. Area in farm land/total area	34.4	82.6	62.1	30.1	54.0	34.3

\* Taken from:

SIECA. The integrated development of Central America in the present decade. Bases and proposals for improvement and restructuring of the Central American Common Market. Study N°4: Integrated Agricultural Development Program. Guatemala, SIECA, October, 1972.

Source: Calculations based on data from GAFICA and other sources.

\*\* Laborers without land and small land holders.



TABLE N°4

**THE AVERAGE PRODUCTION OF VARIOUS CROPS IN CENTRAL AMERICA**

Kg/Ha

<b>Countries</b>	<b>Corn</b>	<b>Beans</b>	<b>Rice</b>	<b>Cassava</b>	<b>Sweet Potato</b>
<b>Costa Rica</b>	1,200	410	1,420	4,500	
<b>El Salvador</b>	1,000	810	1,690	2,800	
<b>Guatemala</b>	800	470	1,180	3,000	
<b>Honduras</b>	700	440	1,640	3,400	2,700
<b>Nicaragua</b>	1,000	720	1,390	3,500	
<b><math>\bar{y}</math></b>	940	570	1,464	3,440	2,700

Source: FAO. Production Yearbook, Vol. 25. Rome, FAO, 1971.

**APPENDIX N°2**

**TROPICAL CROPS AND SOILS PROGRAM**

## DEVELOPMENT OF AGRICULTURAL PRODUCTION SYSTEMS

### FOR THE TROPICS

#### a. INTRODUCTION AND BACKGROUND INFORMATION

Low food production in the tropics is attributed largely to the use of inefficient agricultural production systems. By 'agricultural production system' one means the annual sequence of spacing of one or several crops and the following periods utilized in a given production unit (farm); and their interaction with the resources and technology available, which determines the degree of efficiency.

The majority of the basic foodcrops in Central America is produced by small farmers using traditional cropping systems, many of which are derived from shifting agriculture. These systems do not facilitate stable economic production, especially on chemically poor soils, such as the latosols.

Several types of agricultural production systems have been in use in different parts of the American tropics, with successions of monocropping, mixed cropping and multiple cropping; alternating or overlapping. The most widely used crops in those systems have been corn, beans, rice, several cucurbit species, sweet potato, and cassava.

In the American tropical countries, little research has been done on the study and improvement of the traditional cropping systems utilized by small farmers. This fact alone indicates the need to study the efficiency of these agricultural systems and new ones that are better adapted to the ecological, social and economic conditions of these countries.

Traditionally, agricultural research in the tropics has been patterned after that in temperate zone countries, concentrating efforts on specific

crops or disciplines, and in some cases producing notable improvements in the productivity of certain crops, such as corn, rice, coffee, cocoa, sugar cane, bananas, and others. This success, however, is based on the use of standard technical procedures taken from other ecological areas which, in turn, require heavy investments in land, machinery and agro-chemical products. For this reason, this type of research has benefited mainly those farmers, who have adequate economic resources and large land holdings. The small farmers, who constitute the majority of Latin America's rural population, have not been able to adopt this type of high-input technology, and therefore the production of basic food crops, mainly corn, beans, and root crops, has not significantly improved.

The main justifications for action oriented towards the study of agricultural systems suitable for the tropics and particularly for the small producer, are:

- 1) In Central America, census data show that there is a high population concentration in the rural sector, and that the majority of the farmers own small tracts of land. Approximately 60 per cent of the production units are 5 hectares or less, and 80 per cent are 20 hectares or less. Units having less than 5 hectares predominate (Table N°1, Appendix N°1).

Furthermore, in the rural sections there is a surplus of labor all year round or during certain seasons, poor credit capacity, large family responsibilities and a low standard of living, which have induced migrations to the cities (Tables N°2 and 3, Appendix N°1).

- 2) In Central America, little information exists on the proper techniques to better utilize the small farmer's agricultural systems, or new systems for the adequate utilization of such

resources as property size, capital and available labor, and the ecological conditions of each region.

3) By not having the appropriate techniques available for the direct benefit of the small farmers, the Extension Services feel that their activities are limited in production promotion projects. The small farmer shows little enthusiasm for adopting sophisticated production methods that involve expensive inputs beyond his means.

4) There is an abundant and constant amount of solar energy in the tropics that can be utilized efficiently by crops, if economic techniques are developed that permit a sustained recycling based on the various available sources of energy.

5) The national research and development institutions have new technical personnel trained for conducting research on production systems, and for directing food production and rural development programs.

In order to find solutions to the above mentioned deficiencies, CATIE's Tropical Crops and Soils Program has concentrated its activities since June, 1973, on a Project on "the Development of Agricultural Production Systems for the Tropics", and more specifically, for the countries of Central America and the Caribbean. To carry out this type of research, an interdisciplinary effort was adopted, whereby all the staff works as a team on the project. However, with the magnitude of the problem and the limitations of resources and personnel, it has not been possible to study various factors of primordial importance which would contribute to attaining the project's goals.

**b. OBJECTIVES**

- 1) To compare the production efficiency of the different traditional systems and their modifications, and to develop new agricultural systems for the purpose of selecting those that would make it possible to improve significantly the farmer's income and general welfare, and in particular that of the small producer.
- 2) To identify the most useful and adaptable crops and cropping systems for the different regions.
- 3) To identify and to study the physical, biotic, and ecological environmental factors that act favorably or adversely on production, and to find solutions for controlling the negative factors.
- 4) To study the socio-economic aspects of the recommended cropping systems, particularly in relation to the utilization of labor and farming profits.
- 5) To train technical personnel at various levels, in research and extension on production systems.

**c. GOALS**

In Central America the average farm production of corn, beans, rice, cassava and sweet potato, considered as monocultures, are 940; 570; 1,464; 3,440; and 2,700 Kg/Ha respectively, according to FAO\* (Table N°4, Appendix N°1).

\* FAO. Production Yearbook, Vol. 25, Rome, FAO, 1971.

Experimentally and under the ecological conditions of Turrialba and the South Pacific area of Costa Rica, it is hoped that individual averages can be raised by 30 per cent. However, the goal of the "Production Systems Project" can not be compared directly with existing information on production, since the objective of production systems places special emphasis on sustained production throughout the year, with various crops and not on single harvests, seeking the optimum utilization of land.

- 2) Data recently compiled by ROCAP\* in Central America, indicate that unemployment in the rural areas of the region varies from 6 per cent in Costa Rica to 50 per cent in Honduras, taking male laborers only into account. Furthermore, rural unemployment is seasonal; in El Salvador, for example, the percentage of rural unemployment is less than 2 per cent in November, but more than 64 in October.

Ways must therefore be found to develop systems, that when applied, can best make use of available labor, reducing at least by 50 per cent the rural unemployment problems during the different months of the year.

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\* Regional Office for Central America and Panama. A preliminary assessment of rural economic development in Central America. Guatemala, RRDR, ROCAP, 1974. 81 p.

d. STRATEGY

The initial phase of the Project is being carried out in Costa Rica. At CATIE, in Turrialba, production systems for the wet tropics are being studied. Given adequate financing, it is hoped to study the behavior of production systems designed especially for other ecological areas of Costa Rica. These satellite units of the Turrialba Center will be established in national research and agricultural development institutions.

Using the findings, experience and technology developed at the Turrialba Center and experimental units in Costa Rica, the same or other systems will be tested in the different ecological areas of Central America with the collaboration of national institutions. To carry out this program, a project is being negotiated with the Agency for International Development (AID) that will focus on the Central American area. The specific sites will be selected on the basis of ecological conditions, crops, markets, and zones where farmers are concentrated.

In these production systems, improved early and day-neutral varieties will be tested. Such varieties will come from research centers working on specific crops ((International Center for the Improvement of Corn and Wheat (CIMMYT); International Tropical Agricultural Center-(CIAT); International Rice Research Institute (IRRI); CATIE and others)), or will be local varieties known for their adaptability and use in the regions.

Techniques already developed at the research centers will be adapted for each system including such aspects as time of planting; planting density; fertilizer applications; pest, disease and weed control; and crop and soil management practices.



Special consideration will be given to those crop management practices, which will permit an economical and sustained production throughout the year without involving costly inputs.

The information obtained on the most efficient production systems will be transmitted to organizations dedicated to agricultural development and extension in the countries, so that in turn, the information can be passed on to the local farmers.

e. PROJECT DESCRIPTION

The study and development of production systems were designed for varying degrees of land use intensity and a more efficient use of available energy sources.

The degree of land use intensity means the pressure exercised by a crop or association of crops on the soil under specific management conditions. This pressure or demand depends on the type of crop, the duration of the vegetative cycle of single or associated crops, the fallow interval and the degree of technology applied to the crop. The main objective is to maximize the utilization of the land and available resources in so far as time and space are concerned.

In the first cycle of the main or central field trial initiated in November, 1973, and terminated in November, 1974, 54 treatments each with 4 subtreatments, were studied. The treatments represented a wide range of systems from monocultures and associations of two, three and four crops, distributed in sequence or overlapping in various degrees. The crops used were beans,

rice, corn, sweet potato, and cassava, which are the main basic food crops in the tropics. The subtreatments represented different degrees of applied technology and planting times. In the second cycle, initiated in November, 1974, only 24 treatments each with 2 subtreatments will be tried, representing those systems which appear to be the most promising from the studies made in the first cycle. In the second cycle rice has been eliminated until a variety is found that can adapt better to Turrialba conditions. The two subtreatments are: 1) the minimum degree of technology that would ensure a harvest and; 2) a more advanced technology for each one of the four crops. A randomized block design will be used with four replications, using 180 square meter plots and 90 square meter subplots.

In Costa Rica, studies on agricultural production systems have been initiated in San Isidro de El General, which represents an area with alternating seasonal rain; and Los Diamantes Experimental Station, with a hot, humid climate. In both places crops and systems most widely used locally will be tested, as well as the more promising new systems tried at Turrialba.

In addition to the central experiment, satellite and complementary trials will be made. The former will make it possible to improve certain management and technology aspects of the systems found to be most promising in the central experiment, with respect to changes in varieties used, planting time and density, fertilizers, and disease and pest control, amongst others. The complementary trials permit a detailed study of specific aspects related to production.

A number of satellite and complementary trials are being carried out by graduate and special students as research projects for their thesis requirement, or as special problems.

## ACTIONS IN THE FIRST YEAR

### 1) The Center's Actions

Activities of CATIE's actual technical personnel and resources will make it possible to produce a considerable increment in the first year. Work is being concentrated on the study and correction of problems in soil fertility and physics, crop management, agronomy, plant breeding, nutrition, physiology, horticulture, and plant pathology. A total of 7 highly qualified specialists and the minimum amount of hand labor and inputs for their work are available.

### 2) Justification for requesting assistance

To attain the goals of increasing crop production, in the "Project of Agricultural Production Systems", in comparison with present national average it would be necessary to reinforce the work being done in the following areas, that actually have not been sufficiently studied, and for which economic assistance will be required:

#### a) Production Specialist

Problem: Alterations occur in the photosynthetic efficiency of crops that affect their production, when grown in the field in association or in succession. By not having a Specialist in this field, the Center does not have the fundamental knowledge to increase production in some systems.

#### b) Agronomist - Weed Management and Control Specialist

Problem: Most of the labor is used for weeding, especially in the early stage of planting, but in many cases adequate weed control is not achieved. Up to the present, studies on more efficient and economic methods to

carry out this work have not been done, because of the lack of a Specialist in this field.

c) Support in Entomology

Problem: Insects are among the principal factors limiting food crop production in the tropics. The Government of the United Kingdom has offered to pay the salary of an Entomologist, but the offer does not include the operational costs. Providing funds for this Specialist to carry out his work properly would permit improved pest control.

d) Labor - Auxiliary Staff and Field Workers

Problem: The study simulates the situation of the small producer and requires considerable labor. It is therefore necessary to hire an adequate number of field workers to give support to all the units.

e) Field and Laboratory Equipment

Problem: To resolve some of the technical problems, special equipment, not currently available in CATIE is essential, such as small tractors, field instruments, grain dryers, scales, leaf area integrators, growth chambers, planimeters, and others.

f) Laboratory and Field Supplies, and Materials

Problem: With the energy crisis, all kinds of supplies have become very expensive; particularly agro-chemical and laboratory products, and especially fertilizers and pesticides. These products are necessary in appropriate quantities at all times in order to solve field and laboratory problems, and the support requested would ensure their availability.

g) Travel and Transportation

Problem: It is of primordial importance that the scientific personnel working in the Program have the opportunity to visit the main crop

production areas in the countries of the region and other similar areas, in order to have a complete understanding of their problems and to be able to advise on national programs. In addition, it is necessary that the personnel attend international meetings and seminars, where production problems are discussed. Resources are not available for CATIE's technical personnel to carry out the above-mentioned activities.

h) Library and Publications

Problem: The need for texts and publications in general is indispensable, as specific reference material on Agricultural Production Systems for better orientation, not only in research work, but also for training purposes. What reference material is now available is very limited.

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To illustrate the cost of this Program, the budget for the 1975-1976 fiscal year is given in the following page (Table N°1)

TABLE N°1

**BUDGET FOR THE TROPICAL CROPS AND SOILS PROGRAM -- 1975 --1976**

(in US\$)

<u>A c c o u n t s</u>	<u>Basic Budget</u>	<u>External Support</u>		<u>T o t a l</u>
		<u>Support for Basic Budget</u>	<u>Cost of a New Technical</u>	
<b>1. <u>PERSONNEL COSTS</u></b>				
Professional Staff	183,400		52,400	235,800
Auxiliary Staff:				
Secretaries	13,482	4,592	6,000	24,074
Field & Laboratory Assistants	18,865	2,440	6,000	27,305
<b>T o t a l</b>	<b>215,747</b>	<b>7,032</b>	<b>64,400</b>	<b>287,179</b>
<b>2. <u>OPERATIONAL COSTS</u></b>				
Labor	17,500	8,000	7,000	32,500
Travel	2,007	12,800	8,500	23,307
Service Vehicles (Motor Pool)	3,850	2,800	1,800	8,450
Publications		7,080	2,000	9,080
Equipment		12,000	4,000	16,000
Field & Laboratory Supplies	6,650	15,600	6,400	28,650
Supplies & Services	7,070	11,120	4,800	22,990
Maintenance	3,892	6,848	2,500	13,240
<b>T o t a l</b>	<b>40,969</b>	<b>76,248</b>	<b>37,000</b>	<b>154,217</b>
<b>3. <u>LIBRARY SERVICES</u></b>				
Library		2,400	600	3,000
<b>T o t a l</b>		<b>2,400</b>	<b>600</b>	<b>3,000</b>
<b>4. <u>ADMINISTRATIVE EXPENSES</u></b>				
Director's Office, Administration and General Services	45,304	15,120	18,000	78,424
<b>T o t a l</b>	<b>45,304</b>	<b>15,120</b>	<b>18,000</b>	<b>78,424</b>
<b>G R A N D T O T A L</b>	<b>302,020</b>	<b>100,800</b>	<b>120,000</b>	<b>522,820</b>
<b>%</b>	<b>57.7</b>	<b>19.3</b>	<b>23.0</b>	<b>100.0</b>
<b>Technical Units/Year: 10</b>				

CONDENSED PRELIMINARY REPORT ON THE CROP PRODUCTION

SYSTEMS PROGRAM

Under Turrialba's conditions (humid tropics) 54 production systems were tried, using food crops such as beans, corn, rice, cassava, and sweet potato. The systems represent monocultures, associations of two, three, four, and five crops, distributed in sequence or overlapping in various degrees.

In the monocultures, different technological levels were tested. The lowest level represented that practiced by the small farmer; the highest level utilized the best technology known.

In the majority of the multiple cropping (in association and/or in rotation), a technology level was used that would assure a harvest. It consisted in a fertilizer application that would satisfy the most exacting crop needs, when associations of two or more crops were involved, in addition to current pest and weed control practices.

In Table N°2, results are presented in Metric Tons/Ha and in relative production indices\* for 16 systems, selected as the most promising among those tested during the agricultural year November, 1973 to October, 1974. Since the last harvests in some systems are not yet in, the partial data presented is only on a provisional basis.

From the data contained in the Table, from experience obtained in the first year's research, and considering the average Central American production figures (Table N°4, Appendix N°1) of 570; 940; 2,700, and 3,440 Kg/Ha/year for beans, corn, sweet potato, and cassava, respectively, the following observations

\* Production Index: The sum of the production of each individual crop within the system, compared with the maximum production of the respective monoculture.

can be made:

- 1) Yields from monocultures with high technology were, with the exception of cassava, far superior to the yields obtained with the technology used by the small Central American farmer and its simulation in the trials. The more important inputs for high production using high level technology were fertilizers and pesticides, the largest part of the economic production costs.
- 2) Although individual crop production in the multiple cropping systems with associations of two, three, and successions of crops were not as high as that in the monoculture experiments with good technology, the total production per unit area was always superior, as shown by the production indices, which in some cases exceeded 200%.
- 3) Even without taking the last harvest into consideration, there are some systems with associations of two and three crops which show high production efficiency in tons of commercial products.

The most promising are:

- (a) Associations of beans and cassava planted together for the first crop (treatments 13, 42, 43, 45, 46) followed by a rotation using a different additional crop. In addition to an excellent total weight production, a significant improvement in the diet could be achieved, because of the higher proportion of protein supplied by the beans, as well as the following additional agronomical advantages:



(i) With this combination of crops, the beans grow and produce normally due to the cassava's slow start; apparently they do not compete for light, water, or nutrients.

(ii) The system saves on weeding labor, since with just one weeding of the beans, additional weeding of the cassava is not necessary. By the time the beans are harvested, the cassava is already shading the soil and weed growth is impeded.

(iii) When the cassava roots are harvested, the soil is loosened with the digging, saving time spent on tillage to prepare the soil for the following crop.

(b) The systems using corn and cassava planted together (treatment 15) and corn-cassava together followed by sweet potato (treatment 45), also gave excellent results. In these associations, the corn plant dominated the cassava, that grew notably tall as a result of competition for light.

(c) The systems of corn-beans planted together (treatment 8) and corn-beans planted together followed by sweet potato (treatment 39), also were among the best. The first is among those most commonly used by the small farmer, and the second has the advantage of including an additional crop of sweet potato, which increases efficiency and the usable quantity of foodstuff.

- (d) The system using four crops, planting corn, beans and cassava all together for the first harvest, and sweet potato in the second, also appears to be a good system for the humid tropics.
- 4) Systems using associated or overlapping of crops apparently use fertilizers more efficiently. In the majority of cases, although the individual crops produce fairly well, they show higher crop efficiency when combined than when grown on an individual basis with adequate technology. In Table N°2, the reference to low technology in monoculture systems alludes to no fertilizers, and high technology refers to utilization of fertilizer applications of 133 Kg N/Ha, 200 Kg P<sub>2</sub>O<sub>5</sub>/Ha, and 90 Kg/K<sub>2</sub>O/Ha.
- In the multiple cropping systems (two or more crops) the amount of fertilizer applied bore no direct relationship to the number of crops used in the system. For example, in the systems with two crops (treatments 8, 9, 12, 13, 15, 16), the average increase in fertilizers applied in relation to what was applied for the monocultures was 23 per cent with N, 17 per cent with P<sub>2</sub>O<sub>5</sub>, and 21 per cent with K<sub>2</sub>O; yet, the production indices for each system were quite high. In systems using three crops, the average increase in fertilizers applied was 90 per cent with N, 44 per cent with P<sub>2</sub>O<sub>5</sub> and 82 per cent with K<sub>2</sub>O; the production indices of each system were equally high, although production data for the last crop of corn and sweet potato are still lacking for these systems.

The data presented show that in the multiple cropping systems

the quantities of fertilizers applied are very much below the theoretical level, of 200 per cent, 300 per cent, and 400 per cent in the case of two, three, and four crops, respectively, in relation with a monoculture.

- 5) The multiple cropping systems represent a more efficient utilization of labor for applying fertilizers and in controlling pests and weeds, since the same cost is spread over two or three crops.
- 6) Pests, deficient surface drainage in some plots and diseases are among the more important factors that limit all crop production under the humid conditions of Turrialba. Rice does not grow well under Turrialba's conditions as it is prone to diseases, particularly Helminthosporium and Rhynchosporium, and because of insects attacking its roots. All the crops were seriously affected during the July-September period by soil insects of the genus Phyllophaga.
- 7) The Symptoms of some wind-disseminated diseases are apparently less evident in crops growing in association with another species, than in monoculture plots.
- 8) The crops that competed more efficiently for air space and survival in associations were corn and sweet potato, followed by cassava and beans, in that order.
- 9) In mid-November, 1974, a new trial for the agricultural year 1974-1975 was initiated. Twenty-four treatments were selected as the most promising. They will be tested under two levels of technology: 1) the minimum capable of producing a crop and

2) the high level which will include the best known technology for each crop.

The partial results reported here do not include all the information from the other systems; therefore, the concepts summarized here will have to be modified after a complete analysis is made of the trial.

TABLE N°2

PRODUCTION YIELDS AND INDICES OF SELECTED PRODUCTION SYSTEMS  
IN TURRIALBA, COSTA RICA (NOVEMBER, 1973 TO NOVEMBER, 1974)

Treatment N°	Crop System	Yield (Tons/Ha)			Production Index %
		Beans	Corn	Sweet Potato Cassava	
2a	Beans with low technology	0.78			36
2b	Beans with high technology	2.15			100
49a	Corn with low technology		1.14		36
49b	Corn with high technology		3.21		100
20a	Sweet Potato with low technology		9.86		46
20b	Sweet Potato with high technology		21.57		100
6a	Cassava with low technology			10.88	74
6b	Cassava with high technology			14.71	100
8	Beans**-Corn	1.07	4.19		181
9	Beans-Sweet Potato	1.46	14.57		136
13	Beans-Cassava	0.87		27.86	229
12	Corn-Sweet Potato		0.97	16.43	106
15	Corn-Cassava		2.89	21.43	236
16	Sweet Potato-Cassava		7.50	*	35*
39	Beans-Corn***, Sweet Potato	0.79	4.02	*	162*
42	Beans-Cassava, Corn	1.31	*	20.74	202
43	Beans-Cassava, Sweet Potato	1.61	*	18.60	201*
45	Corn-Cassava, Sweet Potato		3.64	*	184*
57	Beans-Corn-Cassava, Sweet Potato	0.63	0.85	18.08	179*

\* Crop to be harvested shortly.

\*\* Indicates association.

\*\*\* Indicates succession.

ACTION OF THE TROPICAL CROPS AND SOILS PROGRAM AND  
ITS RELATIONSHIPS WITH THE COUNTRIES OF THE AREA,  
AND WITH OTHER INTERNATIONAL PROGRAMS

The Tropical Crops and Soils Program continues to cooperate with IICA's Research Program in the Northern Zone and in the Caribbean, participating annually in research planning meetings on pulses of the Central American Cooperative Program for the Improvement of Food Crops (PCCMCA). In planning sessions for the present year held in Guatemala, El Salvador, Honduras, and Nicaragua, research on associated cropping of pulses with corn has already been included.

Likewise, CATIE continues to give assistance to IICA's Program for the Tropics. Several specialists from CATIE's Program have actively participated in international meetings organized by that Program, intended to outline projects on Agricultural Systems appropriate for the Amazon region.

In Costa Rica, several specialists of the Tropical Crops and Soils Program have participated in national committees on pulses, soils and fertilizers, horticulture, and cacao.

Under an Agreement between CATIE and the University of North Carolina, U.S.A., on a Soils Research Program, several experiments have been conducted on soil fertility and management with food crops, such as corn, beans, soybeans, rice, and sorghum, in several areas of Costa Rica and El Salvador, working in cooperation with national research institutions in these countries.

Through an Agreement with the Tennessee Valley Authority (TVA) of the United States of America, and the company "Fertilizantes de Centroamérica, S.A." (FERTICA), CATIE has carried out studies on new fertilizer formulations

to test efficiency, methods and time of application of fertilizer products on food crops, pasture grasses, cacao, and bananas.

The Center collaborates with national cacao programs in the area, as in Panama, Costa Rica, Honduras, and the Dominican Republic, offering technical assistance to research and agricultural development programs through visits by CATIE staff. In addition, about 700,000 hybrid cacao seeds are produced and distributed annually for rehabilitation programs in these countries.

Since CATIE has the best coffee collection in the hemisphere that includes lines resistant to the Coffee Leaf Rust, the Center has distributed seeds of resistant varieties over the past three years to all the coffee producing countries in the American tropics.

It has also distributed seeds from the pulses germplasm bank, including some 2,000 varieties of beans, soy beans, and cowpeas, to the countries of tropical America.

Negotiations are well under way with the Regional Office for Central America and Panama (ROCAP) of AID to initiate a research project on agricultural production systems of basic food crops, in the five Central American republics. The project is called "Development of Improved Farming Systems for Small Farm Income Generation". This project, already officially accepted by the governments of the area, will be carried out in direct collaboration with national research institutions of the countries concerned. Although this constitutes an outreach project for CATIE, it does not offer support for the Center's core program.

**APPENDIX N°3**

**TROPICAL ANIMAL HUSBANDRY PROGRAM**



## DEVELOPMENT OF MILK AND MEAT PRODUCTION SYSTEMS

### FOR THE TROPICS

#### **a. INTRODUCTION AND BACKGROUND INFORMATION**

The lack of protein in the diet causes malnutrition, which in turn leads to poor human physical and intellectual development. This situation is evident in Central America, and other tropical areas of the continent, where the availability of animal protein is limited, to a per capita consumption of less than 90 Kg of milk and 14 Kg of meat per year.\* This can be an important obstacle to human progress.

Available resources to increase food production of animal origin do exist in Central America. The region has an area of over 12 million hectares in pasture with about 10 million head of cattle\*\*. This, combined with the availability of agro-industrial products and by-products, constitutes the resources for the future improvement of protein sources of the area. However, low food production in the world, and especially in Central America, originates from a poor utilization of the available means. The lack of adequate technology to utilize the area's own resources has led to an extensive and quite inefficient exploitation in milk and meat production, or to an intensification of production using imported technologies based on inputs not obtainable in the area.

In tropical countries, the areas traditionally dedicated to milk production are located at altitudes between 1,200 and 2,500 meters above sea level, where climatic conditions are similar to those of the temperate regions.

\* FAO Yearbook Production, 1970.

\*\* SIECA-GAFICA. The Basis for the Development of the Beef Cattle Industry in Central America and Panama, 1968.

The production systems utilized are based on imported technology from temperate zones, in which the major food inputs are also imported. These production systems tend to increase production costs and decrease the availability of food for the human population concentrated in these areas.

Meat production in the tropics has traditionally been based on extensive and deficient utilization of forages, a food that is abundant and cheap. In the Central American area, average meat production prevailing during the last few years has been 21 Kg/animal/year and 26 Kg/Ha.\*

There have been isolated attempts in animal husbandry research in the tropics, generally by disciplines, and only in very specific areas of animal production. The agronomic aspects of forage production have been emphasized by many research programs in the tropics, as well as the introduction and adaptation of cattle breeds, and the adoption of feeding practices imported from advanced countries. All these isolated efforts have been carried out separately, and not as components of a production system.

On the other hand, little information exists on the profitability of traditional production methods, and hence the need arises to study and compare their efficiency with new livestock production systems that make the most of the area's own resources, and that can be adjusted to the ecological, social and economic characteristics of Central America.

The background situation that would justify developing a project for more adequate meat and milk production systems for the tropics can be expressed as follows:

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\* SIECA-GAFICA. The Basis for the Development of the Beef Cattle Industry in Central America and Panama, 1968.

- 1) The low cattle productivity in the tropical areas is associated with the deficient utilization of the area's own resources, together with other biological, social and economic factors that limit production.
- 2) It is accepted that raising cattle requires less labor per hectare than raising crops. This is true, only if the extensive character of animal production methods, now used, is maintained. In a recent report\*, it has been estimated that with a slight intensification of extensive exploitations until the level found on family type farms is reached, production could well be increased by 130 per cent, doubling the labor needed per hectare.
- 3) In Central America there is little information available on milk and meat production techniques currently in use, or on new systems that efficiently utilize the resources that small, medium, and large producers have at their disposal.
- 4) Considering the existence of extensive pasture lands (12 million Ha in Central America) and the bovine population in that area (10 million head), it is feasible to increase bovine production simply by intensifying the use of the pastures.
- 5) Attempts to increase the production of food of animal origin in tropical regions are not new; great efforts have already been made in the past. However, none of these efforts have been sufficiently profound or prolonged, nor in most cases

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\* Secretariat for Central American Economic Integration (SIECA).  
Study N°4, 1972.

they have been adapted to Central America's own social and economic conditions and facilities.

- 6) The development of research on milk and meat production systems will permit the training of national scientific personnel (which are scarce in the area) to direct and conduct food production programs.
- 7) In Central America there are no research programs on production systems. CATIE's Tropical Animal Husbandry Program, through the technical assistance that it offers to the countries of the area, has as one of its main objectives the strengthening of national institutions and to cooperate in its present work towards a solution of production problems.

Due to the lack of research on milk and meat production systems, CATIE's Tropical Animal Husbandry Program has been carrying out its activities, and concentrating its efforts and resources on a Project: "Development of Milk and Meat Production Systems for the Tropics". This is based on the efficient utilization of resources prevailing in the region; the grasses, legumes, agricultural products and by-products that can be transformed by animals into high biological value food for human consumption. This Project has made it possible to put into practice an interdisciplinary mode of working, with various specialists collaborating in an integral manner on the development of systems, rather than as isolated production disciplines.

#### b. OBJECTIVES

- 1) To evaluate the efficiency of different cattle production systems, and to select those that contribute to an increase

in productivity beneficial to the farmer.

- 2) To identify the ecological, biological, economic and social factors that determine yield from milk and meat production methods used in the tropics.
- 3) To train professionals at various levels in research on animal production methods.

**c. GOALS**

**1) In Milk Production**

In Latin America the production/animal/year is estimated to be 850 Kg, using an area of 2.1 Ha\*. In Central America -- although there is no information available-- these values are considered to be superior to those obtained throughout the region.

Experimental work under Turrislba conditions indicates that milk production per unit area and per animal could be increased by more than 100 per cent, simply by introducing better forage utilization systems.

**2) In Meat Production**

In Central America available data indicate that the production of meat/animal/year is 21 Kg and 26 Kg/Ha with a stocking rate of 1.25 head/Ha.\*\*

\* The White House: The World Food Problem II, 1967.

\*\* SIBCA-GAFICA. The Basis for the Development of the Beef Cattle Industry in Central America and Panama, 1968.

Trials made by the Tropical Animal Husbandry Program indicate that beef cattle yields can be increased considerably in relation to the region's averages. Production of 5 Kg/Ha/day and of 250 to 300 Kg/animal/year have been obtained in Turrialba by a better utilization of forages and the use of agro-industrial by-products as supplement.

d. STRATEGY

The Project "Development of Milk and Meat Production Systems for the Tropics" has been functioning in its first stage in Turrialba, Costa Rica. Due to the fact that research in cattle production techniques requires large extensions of land, a large number of animals, and extensive physical facilities, it is necessary to have the collaboration of national research institutions to study and carry out those systems that can be adapted to the different ecological areas of Central America.

The Project contemplates various research phases:

1) The integration of existing information on the different components of a system (feeding, animal health, management, breeding, etc.). Therefore, to this end, the knowledge, experience and techniques developed at CATIE, as well as those developed at the national and international research institutions, will be utilized. 2) Generating new information for the system. In view of the varied number of problems and factors that limit milk and meat production, there is a need for new concepts with respect to the components of the system. With this objective in mind, research activities will be carried out at CATIE and at national institutions (Panama and Costa Rica) to function as satellite units of the Turrialba Center's program.

3) The integration of information on the development of milk and meat production systems. Various production methods exist that depend on the final product desired, on the way of utilizing resources (semi-intensive, intensive, and extensive), and the ecological area where they are established (tropical and temperate zones). Specific data on some aspects of animal production are available, which should be integrated into a scheme to evaluate the interactions of the different components of cattle productivity. 4) The adaptation and extension of the production systems. These systems should be adapted to the environment, in order to fit the biological, ecological, economic and social conditions of the area where they will be used. In order to be adopted they should be demonstrated, and the information obtained will be distributed through organizations dedicated to agricultural development and promotion, or Extension Services in the countries, which, in turn, will be responsible for transmitting the information to the producers.

The mechanism for carrying out this research strategy will be as follows:

- 1) CATIE, as the main research and training Center, has as its purpose the strengthening of national research programs and technical assistance,
- 2) National research centers located in diverse ecological areas of the Central American countries. Their objective will be to develop the different phases of the strategy, in coordination with the main center.
- 3) The integration of national committees responsible for the planning, execution and evaluation of research.

e. PROJECT DESCRIPTION

The research on the development of milk and meat production systems for the tropics has as its main objective the efficient utilization of the area's resources: grasses, legumes, agricultural products and by-products which can be transformed by animals into high value biological food for human consumption. Bovines have been selected for these systems because this animal species can better transform the resources that are non usable for human consumption. Among them, forage is the most abundant and the cheapest resource in Central America. In addition, there is a long tradition of animal husbandry in these countries, and this is one of the mainstays of their economies.

Research activities on systems development cover the diverse phases described above under 'Strategy'.

At present, available information from other areas and that produced by CATIE on system components are being integrated into the following three production systems:

- 1) Milk production systems.
- 2) Meat production systems.
- 3) Mixed meat and milk production systems.

In these, the interactions produced by integrating feeding, animal health, breeding and management components for the production of milk and meat are being studied. In the case of milk production, the system involves all the stages from raising replacement heifers to milk production. In beef cattle the system involves all stages from breeding to slaughter.

The main objective is to measure the efficiency of the utilization of resources by the system and its transformation into milk or meat.



In addition to the central study, satellite and complementary research studies are also being carried out. These satellite studies will make it possible to improve the management and technological aspects of the system's components (feeding, breeding, etc.). The complementary studies will permit research on more specific matters related to the system's components such as: protein or energy levels, grazing pressure, or grass species to be utilized in the feeding schedules. These experiments will produce new data that can be integrated into the study.

Research on adaptation, demonstration and the dissemination of information concerning the system is being conducted in cooperation with national institutions in Costa Rica and Panama. In Costa Rica the "Project on Milk Production for the Atlantic Zone" has been approved, which will involve the Ministry of Agriculture and Animal Husbandry (MAG), the Institute of Lands and Resettlement (ITCO), the Central Bank, and the National Production Council (CNP). This Project has as its specific purpose to demonstrate and adapt to the Atlantic area of Costa Rica the milk production system practiced at CATIE. In order to comply with the objectives and goals defined in this Project, and to contribute to the strengthening of national institutions, financial assistance will be required to support the Program's present budget. The economic assistance requested for the 1975/1976 year appears in the Tropical Animal Husbandry Program budget. The proposal includes support for the basic budget of 23.7 per cent and the incorporation of a new unit that constitutes 17.9 per cent of the total budget (Table N°1). Without doubt, this economic support will contribute to strengthening the Program and will make it possible to intensify the various research activities already under way.

To illustrate the cost of this Program, the budget for the 1975-1976 fiscal year is presented. (Table N°1).

[The remainder of the page contains extremely faint and illegible text, likely representing the budget details for the 1975-1976 fiscal year.]

**TABLE N°1**

**TROPICAL ANIMAL HUSBANDRY PROGRAM BUDGET --1975/1976**

(in US\$)

<u>A c c o u n t s</u>	<u>Basic Budget</u>	<u>Outside Support</u>		<u>T o t a l</u>
		<u>Support for Basic Budget</u>	<u>Cost of a New Technical Unit.</u>	
<b>1. PERSONNEL COSTS</b>				
Professional Staff	131,000		26,200	157,200
Auxiliary Staff:				
Secretaries	11,000	1,500	3,000	15,500
Field & Laboratory Assistants	5,270	9,730	3,000	18,000
<b>T o t a l</b>	<b>147,270</b>	<b>11,230</b>	<b>32,200</b>	<b>190,700</b>
<b>2. OPERATIONAL COSTS</b>				
Labor	7,176	12,825	4,000	24,001
Travel	1,250	7,515	2,000	10,765
Service Vehicles (Motor Pool)	1,500	2,000	800	4,300
Publications		2,500	500	3,000
Equipment		10,000	3,000	13,000
Field & Laboratory Supplies	6,000	14,800	5,700	26,500
Supplies & Services	1,750	2,250	1,250	5,250
Maintenance	1,000	2,500	1,250	4,750
<b>T o t a l</b>	<b>18,676</b>	<b>54,390</b>	<b>18,500</b>	<b>91,566</b>
<b>3. LIBRARY SERVICES</b>				
Library		1,700	300	2,000
<b>T o t a l</b>		<b>1,700</b>	<b>300</b>	<b>2,000</b>
<b>4. ADMINISTRATIVE EXPENSES</b>				
Director's Office, Administration & General Services	29,284	11,880	9,000	50,164
<b>T o t a l</b>	<b>29,284</b>	<b>11,880</b>	<b>9,000</b>	<b>50,164</b>
<b>GRAND TOTAL</b>	<b>195,230</b>	<b>79,200</b>	<b>60,000</b>	<b>334,430</b>
%	58.4	23.7	17.9	100

Technical Units/Year: 6

ACTIONS ON THE BASIS OF REQUESTED CONTRIBUTION AND THE  
CORRESPONDING JUSTIFICATION

If the goal to increase milk and meat production in comparison with regional averages is to be reached, it is going to be necessary to strengthen research activities in the following areas, thus, economic aid is logically a decisive factor:

a. NEW UNITS

Specialist in Animal Health. The existing problems in animal health are causing high animal mortality at all ages, and a low reproduction rate in many herds. As a consequence, a Veterinarian is required to improve cattle production systems.

b. SUPPORT FOR THE BASIC BUDGET

The Tropical Animal Husbandry Program presently has 5 Technical Units. However, for these Units to carry out their different activities more efficiently, a basic budget is required which includes the following items:

1) Labor - Assistants and Field Laborers

In Animal Husbandry --due to the area size and number of animals used in research-- it is necessary to have an adequate number of field laborers to work with the Units.

2) Field and Laboratory Equipment

To solve some of the specific production problems, essential equipment to carry out this work is needed. The minimum equipment required includes: dryers for grass samples, scales,

forage harvesters, small silos, nutrient analyzers, etc.

3) Laboratory and Field Supplies and Materials

Cattle research requires a large amount of materials, especially for feeds, as well as fertilizers and medicines, insecticides and veterinary products.

4) Travel and Transport

It is of prime importance that the technical personnel working in the Program have the necessary economic means to visit production areas and become familiar with national programs, with the purpose of identifying the problems, in such a way as to be able to make the necessary adjustments in their research and counseling services to national programs. It is also essential that they participate in regional and national technical meetings and seminars, where the current and pressing production problems are discussed.

REPORT ON ADVANCES OBTAINED BY THE ANIMAL HUSBANDRY PROGRAM, IN THE  
DEVELOPMENT OF MILK AND MEAT PRODUCTION SYSTEMS FOR THE TROPICS

Research work at the Tropical Animal Husbandry Program has been focussed on the study of soil, plants, environment and animals as basic components of milk and meat production. The integration of all the available information, into milk and meat production systems, is the new slant in research work currently underway. Some of the results obtained by the Program are presented below:

a. MILK PRODUCTION

- 1) Animal breeding in the Tropics constitutes an important component of the milk production system. Research results obtained in Turrialba indicate that the use of crosses between two breeds increased milk production of the system by 21.7 per cent (Table N°2), in comparison with that of pure breeds. If these results are compared with the average production per cow (850 Kg) in Latin America, an increase of up to 200 per cent in milk production is noted. This was accomplished without affecting the reproductive behavior of the herd (1.9 services per pregnancy and 12.5-month calving interval).
- 2) The raising of replacement heifers is a fundamental phase in milk production. The system developed at CATIE can be characterized by a minimum use of milk in feeding animals, utilizing pasture at a very early age and cheap supplements (based on such by-products as molasses, bananas, urea and others). As a result, an animal is ready to breed at an earlier age than by following traditional systems.

This results in more milk for human consumption, forages are utilized much sooner, an animal is obtained that is better adapted to the prevailing pasture conditions (resistance to diseases and parasites), and facilitates the adoption of the system by producers having limited economic resources (Table N°3).

3) **Milk Production:** The results obtained as far as feeding, genetic aspects of management and animal health are concerned, have been integrated into a milk production system. The use of this system, based on the intensive utilization of forage (daily rotation) with stocking rates of 5.4 head/Ha, indicates that it is possible to obtain 11,862 Kg of milk/Ha/year with a daily production of 6.0 Kg/animal. These results are comparable to those obtained in temperate zones, and considerably exceed the average production found in the Central American countries.

b. **MEAT PRODUCTION**

1) The use of crosses in beef cattle has contributed to increasing the productivity of production systems. Data obtained at CATIE reveal that Hybrid animals exceed pure breeds in weight at birth by 4.8 per cent, 17.7 per cent at weaning, and 8.7 per cent at 13 months of age (Table N°4). These results, compared with the average results of the Central American area (weight at weaning: 145 Kg; weight at 13 months: 180 Kg), indicate that the exploitation of hybrid vigor can help obtain weight increases in meat production systems for the tropics.

- 2) Meat Production on the Basis of Grazing. The utilization of agro-industrial by-products as supplements for grazing cattle is an important alternative that could solve the problems of the seasonal production of pasture grasses. Results obtained at CATIE indicate that if pastures are abundant and of high quality, supplements do not improve cattle production. When the availability of the grass diminishes, or stocking rates are increased, supplementation is beneficial, increasing animal production, yield per hectare, and economic profitability. These results make it possible to take advantage of available resources, in a systematic and efficient way, which in economic terms means a return of more than a 100 per cent on invested capital.
- 3) Intensive Fattening in Feed-lots. Feed-lot fattening of steers has been investigated in an attempt to obtain adequate meat production, considering time as a factor and the utilization of local resources. This implies producing animals for slaughter under two years of age, the intensive use of tropical by-products not used for human consumption, and the maximum utilization of the economic inputs that this type of enterprise requires, in order to be able to achieve an integral beef cattle production process for the Tropics. Thus, two fattening systems were developed: one based on using reject (culled) bananas, and the other on sugarcane by-products.
- Weight gains are high in the case of feeding cattle molasses, bagasse and urea, and are comparable to those obtained in advanced countries. This weight increase diminished, however, when increasing levels of



urea were included. On the other hand, the gradual replacement of the protein supplement by urea caused a lineal increase in economic profits. For example, by replacing 60 per cent of the protein with urea, the net profit was \$0.16/animal/day, with a weight increase of 1 Kg/animal/day.

As far as fattening with bananas, increases in weight gain of approximately 1 Kg/day were also obtained, incorporating high levels of protein into the ration. Due to the fact that reject green bananas are very cheap (transportation is the only cost), the economic benefit from this type of operation is significant, being 78 per cent of the value at a level of 218 g of protein/100 Kg of live weight. In view of the large amounts of bananas available, these results have special practical importance for the banana producing areas of the Central American Isthmus.

These are some of the most important experiments being conducted by the Tropical Animal Husbandry Program. Some of the achievements are already being used by producers, contributing in this way to increasing production. However, it is necessary to adapt other results obtained, to the different prevailing conditions in the region, and to continue producing new information.

TABLE N°2

**MILK PRODUCTION AND REPRODUCTIVE BEHAVIOR OF THE DAIRY**

**HERD IN TURRIALBA**

<b>Breed</b>	<b>Milk Production (Kg)</b>	<b>Services/Pregnancy (N°)</b>	<b>Interval between Births (Days)</b>
<b>Criollo (C)</b>	<b>1,945</b>	<b>1.7</b>	<b>387</b>
<b>Jersey (J)</b>	<b>2,151</b>	<b>2.2</b>	<b>377</b>
<b>F<sub>1</sub> (J x C)</b>	<b>2,493</b>	<b>1.7</b>	<b>373</b>

**Source: Deaton. Activities at Turrialba, 1974.**

**TABLE N° 3**

**THE RAISING OF REPLACEMENT HEIFERS IN THE DAIRY HERD**

	<b>Traditional Systems</b>		<b>Improved Systems</b>
	<b>A</b>	<b>B</b>	
<b>Weight gain, Kg/day</b>	500	270	500
<b>Milk consumption, Kg/calf</b>	600	600	120
<b>Concentrate consumption, Kg/calf</b>	700	1,000	600
<b>Age of being put out to pasture, months</b>	12	6-8	1.5
<b>Insemination age, months</b>	12-18	24	11-12
<b>Cost of feeding heifer at insemination age, in US\$</b>	400	400	150

TABLE N°4

PRODUCTION DATA OF CRIOLLO, BRAHMAN AND SANTA GERTRUDIS  
BREEDS, AND SIX RECIPROCAL CROSSES

Breed of Parents		Birth Weight Kg.	Weaning Weight* Kg.	Weight at 13 months Kg.
Paternal	Maternal			
G	G	32.5	208	264
G	B	27.3	206	272
G	C	31.3	213	265
B	B	27.5	190	246
B	G	36.5	229	295
B	C	35.5	230	296
C	C	29.1	204	253
C	G	30.7	213	270
C	B	25.4	204	273
$\bar{X}$		30.7	211	271

G = Santa Gertrudis; B = Brahman; C = Criollo

\* 8 months old.

Source: Muñoz and Martin, 1969.

ACTION OF THE TROPICAL ANIMAL HUSBANDRY PROGRAM IN THE  
COUNTRIES OF THE AREA AND IN OTHER INTERNATIONAL PROGRAMS

The work of the Tropical Animal Husbandry Program should be projected to the countries in the area. The work of publicizing research results and technical capacity of the Program has received particular attention in the past, and should be strengthened even more in the future.

An Agreement was signed with the Panamanian Government to cooperate with the Ministry of Agricultural Development (MIDA) to promote cattle production. This Agreement contemplates the hiring of a highly qualified specialist by CATIE, to be located at Gualaca, Chiriqui, site of the "Research Project on Animal Sciences". Thus, close ties will be maintained between CATIE and Panama. This will ensure a rapid verification of research results from Turrialba and MIDA's experimental stations. CATIE's professionals make periodic visits according to MIDA's research plans. An effort is being made to coordinate the work of MIDA's extension service with the research projects so as to ensure a rapid dissemination of the more promising research results.

The Tropical Animal Husbandry Program is actively collaborating with the "Regional Pastures and Forages Project", an activity coordinated by IICA. This Project endeavors to combine regional efforts in research and demonstration techniques that are underway in the Central American Isthmus.

Recently a request has been received from the Honduran Government for the Program to give advisory services on the reorganization of its "Animal Production Program". This includes such aspects as research and the promotion of animal husbandry.

Under the terms of an Agreement with the Tennessee Valley Authority (TVA), CATIE has initiated work on the evaluation of new types of fertilizers

for grass production in pastures.

Since the beginning of the IICA-USAID-University of Costa Rica

Contract, Program staff have been collaborating in orienting the Animal Science School of the Agricultural Branch of the University in its programs. Technical assistance is being given under the terms of the Contract to strengthen the University's research work in this area.

Collaboration has been given to the Costa Rican Ministry of Agriculture and Animal Husbandry (MAG) on the elaboration of "National Programs for Swine Production and Forage Production". In addition, two Program staff members are on the "National Committee for Agricultural Development". In collaboration with MAG, various projects on cooperative research are being carried out. This involves work being done at three of MAG's experimental stations, that deal with the use of supplements to grazing, and the management and utilization of pasture grasses.

As a way of publicizing research results, the Program has proposed the installation of a "Model Dairy Farm in the Humid Tropics". In this Project, MAG, the Institute of Lands and Resettlement (ITCO), IICA, the Central Bank of Costa Rica through its Technical Department, the Banking System, and the National Production Council (CNP) will participate.

Program personnel have participated in Latin American courses in animal production, in the United States of America, as well as in those countries where courses were offered in connection with Central American cattle expositions. The Program took advantage of these events to inform the producers of the results from the Program's work.

In addition, several professionals have participated in international forums where the role of Animal Husbandry in the tropics was discussed, giving CATIE an opportunity to express the philosophy of its work.

Program staff members have collaborated in graduate courses in Mexico, and in production courses in Haiti. Through the collaboration of the OAS, four intensive courses were given at the Center, courses which were extremely beneficial to researchers and university professors from all over Latin America, to up-grade and up-date their knowledge. There has been great interest in these courses.

Several practical animal husbandry courses have also been offered with the objective of familiarizing the participants with modern production techniques. This constitutes part of the Program's informal training, and is carried out with the assistance of CATIE's graduate students.

Cattlemen and their associations, and some private institutions ((Pfizer; Costa Rican Development Corporation, S.A.,(CODESA); etc.)) have collaborated actively in several projects, representing one more tool for the extension of modern production technologies.

**APPENDIX N°4**

**NATURAL RESOURCES PROGRAM**



## MANAGEMENT AND UTILIZATION OF THE FOREST RESOURCES IN

### THE CENTRAL AMERICAN AND CARIBBEAN AREA

The forest resources of Central America and the Caribbean are currently being exploited without any consideration for the future. With the growing population and the increasing scarcity of forest products, there is a need to increase their availability to satisfy the growing demand.

Native species and introduced fast-growing species, in homogeneous plantations of promising economic production, should provide the necessary stimulus to private industry, as well as to government agencies, to increase forest research programs and train specialists in the different areas of the forest sciences.

Some isolated work has been done in all of the countries, but in critical situations requiring immediate attention, the lack of trained personnel and organization to do the job are obstacles to be overcome. The need to control forest exploitation in Costa Rica, as well as in all of Central America, a situation that requires a great deal of work and in personnel training, is cited as an example. However, this essential work cannot be carried out because of the above-mentioned reasons.

Since Program specialists are in continuous contact with the Central American and Caribbean area, the problems and critical sectors of the region have been identified.

In Panamá there is an urgent need for the proper utilization of forest soils, watershed protection and the rational utilization of national reserves and parks. Similar problems have been observed in El Salvador.

In Nicaragua, Honduras and Guatemala, forest fire protection projects have been developed for conifer forests in which heavy investments have

been made. These projects need constant technical assistance to achieve their objectives.

Costa Rica has a high consumption rate of forest products, and is deforesting between 50,000 and 60,000 hectares a year, making the need for a rational exploitation of its forest lands absolutely essential, to ensure adequate forest, land and water for the future.

Irrational utilization of the humid tropical forest resources occurs in the valuable forest areas of El Peten, Guatemala, for example. The situation there requires immediate planning for the rational utilization of the area's resources. The Program has been providing important advisory services to the silvicultural research projects in El Peten over the past two years, as part of a five-year research project conducted by FAO.

The Natural Resources Program of CATIE has been cooperating actively in the forest development of several countries, as may be seen in the section on "Program Action in the Countries of the Area".

Aware of the forest problems in the Central American and Caribbean areas, the Program has oriented its efforts towards the following: Silviculture, Forest Improvement, Watershed Management, Forest Management, Fire Control, Wood Technology and Forest Entomology.

#### a. SILVICULTURE

Over the past eight years, CATIE has been working on the introduction of over 200 species of the tropical world. Lack of resources has not permitted extending similar research programs to other ecological zones of the Central American or Caribbean areas. Until this can be done, it would be dangerous to suggest the reforestation of large areas to the governments, even though the

best species for some of the ecological zones of the region have already been determined.

The Natural Resources Program has maintained the Latin American Forest Seed Bank (BLSF) over the past eight years, with the aim of meeting the demands for forest seeds from the Latin American countries and those from tropical areas, both for research as well as promotional purposes. This work has intensified considerably over the past two years, and many requests for seeds are being met each year. The need for more resources is obvious, and it must be recognized that Turrialba is centrally located, facilitating the acquisition as well as the distribution of forest seeds.

**b. FOREST IMPROVEMENT**

The selection, production and distribution of forest seeds comprise the basis for forestation programs of both exotic and native species. The Program is working on tree selection in both the conifers and the broadleaf species to obtain improved genetic material as a basis for work in forest improvement.

**c. WATERSHEDS**

The continued irrational exploitation and inadequate utilization of natural resources, and the resulting effects on the environment of the Central American Isthmus have been recognized for some time. Due to extreme levels of contamination and the high costs involved in correcting past errors, watershed management has gained considerable prestige over the past few years.

By means of its new programs in Watershed Research, CATIE is attempting to define and comprehend the different interacting factors in the watersheds

of tropical humid areas, and it is hoped that the acquired knowledge may be utilized in evolving techniques to help correct and prevent errors.

There is currently a Watershed Management Project in El Salvador. However, to ensure the continuity of these efforts, it is absolutely essential to train additional personnel.

Due to the lack of technical personnel trained in the field of watershed management in the countries of the area, CATIE is interested in training the professionals needed to help solve the problems of each country.

#### d. FOREST MANAGEMENT

Recognition of the rational utilization of forest resources is essential for the economic development of the countries in the Central American area, particularly in view of the fact that over 50 per cent of the area is in natural forest.

Currently, no less than 300,000 hectares of virgin tropical forest are destroyed annually in the Central American region; often the wood is burned, not harvested. This exploitation is being conducted without adequate studies or plans for the renewal of the forest mass which is being eliminated.

The situation lends itself to the possibility of utilizing silvicultural systems to enrich extensive areas already exploited with the more promising forest species in each ecological region so as to produce a high volume of wood per unit area. Important research on this aspect has been conducted in the past at Turrialba, and the results are being disseminated through out the Central American and Caribbean areas.

e. FOREST FIRE CONTROL

Approximately 40 per cent of the Central American area from Nicaragua to Guatemala is under natural conifer forests.

Due to the growing demand for agricultural land in the region, shifting agriculture is being practiced on the marginal soils. The moderate use of fire in this process results regularly in forest fires.

The Central American region has indicated considerable interest for specific fire control projects, on a short range basis. As long as there is insufficient training in the area, the efforts of the countries will not be adequate to attain permanent fire control in the existing conifer forests of Central America, nor will the deterioration of important natural resources such as soils and water be eliminated.

The periodic forest fires weaken the forest mass from a biological point of view, favoring pest attacks and forest diseases. A typical example in the region is the loss of 500,000 hectares of pine forest to the beetle Dendroctonus frontalis.

f. WOOD TECHNOLOGY

Over 2,000 forest species have been identified in the humid tropical forests. Only about 300 of these have actually been studied to determine the physical and mechanical characteristics of the wood.

The Forest Products Laboratory, which the Program maintains on the University of Costa Rica campus in San Jose, is the only one of its kind in the region. The reenforcement of its capacity to conduct these studies would increase the utilization of tropical forest species, which in turn would facilitate a more rational management and utilization of these forests.

g. FOREST ENTOMOLOGY

Due to the wide diversity of broadleaf species found in the natural forest, a biological equilibrium is set up which makes it difficult for diseases and pests to become established and develop. The converse is true in the case of the monocultivation of forest plantations, where phyto-sanitary problems are considerable. An example of this can be seen in the reforestation of tropical regions with spanish cedar and mahogany and the appearance of the Meliaceae shootborer, Hypsipyla grandella Zeller.

Homogeneous conifer forests not subject to silvicultural practices, such as thinning and improvement, are easy pray to massive attacks of forest pests in the Central American area.

To prevent serious losses in the reforestation program, phyto-sanitary problems must be avoided by means of studies to identify the forest pests and to comprehend their population dynamics. At the same time, it is important to investigate means of biological and chemical control, as in the case of the use of systemic insecticides in the experiment on the control of the Meliaceae shootborer.

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A budget summary is presented to illustrate the cost of this program for the 1975-76 fiscal period (Table N°1).

TABLE N°1

**NATURAL RESOURCES PROGRAM BUDGET -- 1975 - 1976**

(in US\$)

<u>A c c o u n t s</u>	<u>Basic Budget</u>	<u>Outside Support</u>		<u>T o t a l</u>
		<u>Support for Basic Budget</u>	<u>Cost of a New Technical Unit</u>	
<b>1. PERSONNEL COSTS</b>				
Professional Staff	104,800		26,200	131,000
Auxiliary Staff:				
Secretaries	9,000	3,500		12,500
Field & Laboratory Assistants	9,138	7,062		16,200
<b>T o t a l</b>	<b>122,938</b>	<b>10,562</b>	<b>26,200</b>	<b>159,700</b>
<b>2. OPERATIONAL COSTS</b>				
Labor		19,500		19,500
Travel		7,000		7,000
Service Vehicles (Motor Pool)	1,000	6,000		7,000
Publications		6,500		6,500
Equipment		10,000		10,000
Field & Laboratory Supplies		7,000		7,000
Supplies & Services	800	5,238		6,038
Maintenance		2,000		2,000
<b>T o t a l</b>	<b>1,800</b>	<b>63,238</b>		<b>65,038</b>
<b>3. LIBRARY SERVICES</b>				
Library		2,000		2,000
<b>T o t a l</b>		<b>2,000</b>		<b>2,000</b>
<b>4. ADMINISTRATIVE EXPENSES</b>				
Director's Office, Administration & General Services	22,012	13,377	4,623	40,012
<b>T o t a l</b>	<b>22,012</b>	<b>13,377</b>	<b>4,623</b>	<b>40,012</b>
<b>GRAND TOTAL</b>	<b>146,750</b>	<b>89,177</b>	<b>30,823</b>	<b>266,750</b>
%	55.0	33.4	11.6	100.0

Technical Units/Year: 7

PROGRAM ACTION IN THE COUNTRIES OF THE AREA

The Forestry Sciences Program of CATIE has cooperated with the countries of the region in the following manner:

a. PANAMA

1. Ecological mapping of the country, according to Holdridge's life zone classification system.
2. Identification of the forest species in the tropical forests.
3. Technological studies of 113 forest species.
4. Technical assistance on the determination of appropriate zones for national parks, reserves and recreational areas.
5. Some ecological characteristics of the swamp forests of the Darien.
6. Census of saw mills and lumber industries.

b. COSTA RICA

1. Ecological mapping of the country, according to Holdridge's life zone classification system.
2. Publication of the 'Manual of the Common Trees of Costa Rica'.
3. The forest industries of Costa Rica.
4. Technological studies of 32 forest species of the Rio Macho and Cariari area.
5. Exploratory and detailed inventory of 20,000 hectares of humid tropical forest in the Rio Barbilla and Valle Escondido areas.
6. Sixty-three theses on different subjects pertaining to Costa Rican forestry.



c. NICARAGUA

1. Ecological mapping of the country, according to Holdridge's life zone classification system.
2. Technical assistance provided the Tahal Company. Pre-investment projects for the development of the Rio Escondido Watershed.
3. Technological study of 15 tropical forest species. FAO Project.
4. Two research theses on the ecological zoning and management of conifer forests.

d. HONDURAS

1. Ecological mapping of the country, according to Holdridge's life zone classification system.
2. The dendrological and anatomical identification of 37 tree species.
3. The ecological zoning of Pinus caribaea var. hondurensis.
4. Census of saw mills and lumber industries.
5. Advisory services provided the Ministry of Agriculture on the last declaration of national forest reserve zones.

e. EL SALVADOR

The ecological zoning of the country, according to Holdridge's life zone classification system. Due to the almost total absence of forest resources, the country has an important 'Reforestation Plan' and has made use of the services of the Latin America Forest Seed Bank (BLSF).

**f. GUATEMALA**

- 1. Ecological zoning of the country.**
- 2. Technical cooperation on the forest policy programming for the country.**
- 3. Technical assistance provided for two years to the El Peten sector.**
- 4. Ecological studies of the humid tropical forest of El Peten.**

ACTIONS ON THE BASIS OF REQUESTED CONTRIBUTION AND THE CORRESPONDING JUSTIFICATION

a. FOREST PRODUCTS TECHNOLOGY

In recognition of the tremendous increase in the utilization of forest products in Costa Rica and throughout Central America, FAO provided the opportunity in 1967 to set up a Forest Products Laboratory.

Up to 1971, the services of the Head of this Laboratory were financed by FAO. Since then, the Laboratory has been functioning with only national professional personnel due to economic restrictions. In view of the tremendous responsibilities implied in the running of this Laboratory, the hiring of an appropriate Laboratory Head is urgent. The service provided to the industries of the countries of the region is financed through an Agreement with the Ministry of Agriculture and Animal Husbandry of Costa Rica (MAG), the University of Costa Rica and CATIE. The Laboratory is located on the University campus.

b. FOREST ENTOMOLOGY

The Government of Austria has offered assistance in this area, and is assigning the services of an Associate Expert, through FAO. However, the only contribution in this important sector of forestry is the financing of the expert's salary.

As of 1961, the Program initiated work on the introduction of fast-growing native and exotic species; work on the latter species was intensified in 1977 with 200 species from tropical areas of the world. The existing experimental plantations in this first stage already have some phyto-sanitary problems which should be studied.

**c. FOREST FIRE CONTROL**

The Government of the United Kingdom has decided to collaborate in this field with the contribution of an expert who is currently doing important work on the subject in the tropical forests of Belize.

The contribution consists in the salary of this Expert, nonetheless, support for his work is needed, since the problem of forest fire control in the Central American area is of considerable importance with respect to forest production.

**d. SILVICULTURE, FOREST MANAGEMENT, WATERSHED STUDIES AND FOREST IMPROVEMENT**

The specialists in the Natural Resources Program of CATIE in the fields of Silviculture, Forest Management, Watershed Studies and Forest Improvement are financed by the regular CATIE budget, but the operative expenses for their work must be covered almost entirely if success is to be achieved in the pursuit of their objectives.

**APPENDIX N°5**

**TECHNICAL ASSISTANCE PROGRAM**

## TECHNICAL ASSISTANCE PROGRAM

The inclusion of this Program, which will start with the two specialists requested in the proposal, was considered necessary. The aim is to attain a unit within this Program, comprised of four specialists. However, for the first year, a Systems Analyst and an Economist are contemplated.

### a. SYSTEMS ANALYSIS

As all the Center's Research Program is oriented towards developing production systems, the participation of an Analysis Expert acquires priority. The interactions of the different factors which permit agricultural systems to function efficiently are not known. Biological, physical and climatological data are being collected with respect to the variables related to production systems, in crops, animal production or forest aspects. An Analyst could work with this material --utilizing the computer facilities available at CATIE-- to program systems and simulate new alternatives adjusted to the diverse ecological conditions prevailing in the region where the systems are to be applied.

### b. ECONOMIST

The net income of small farmers is greatly reduced through the low profitability factor of his exploitations. It is therefore necessary to evaluate the efficiency of the improved production systems currently being studied, but unfortunately CATIE does not have an Economist to conduct this evaluation. Nonetheless, basic economic data are already being compiled.

Recommendations to the farmers must be backed up by serious economic studies, as only the agricultural practices which meet the farmers' social conditions as well as the ecology of the area should be proposed. They should also offer the best possibility for success with respect to the utilization of

the resources the farmers have available, and the profit derived from their work.

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Within a five-year projection, it is felt that the Program will need a complement of a Sociologist-Extensionist and an Ecologist. Both specialists would be of considerable importance and value for the projection of the research programs.

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To illustrate the cost of this Program, the budget for the 1975-76 fiscal year is presented. Since the Technical Assistance Program is new, the total amount needed to finance it is contemplated under the requested outside support.

TABLE N°1

TECHNICAL ASSISTANCE PROGRAM BUDGET --1975-1976

(in US\$)

	<u>Cost of Two Technical Units</u>
<b>1. <u>PERSONNEL COSTS</u></b>	
Professional Staff	52,400
Auxiliary Staff:	
Secretaries	6,000
Field & Laboratory Assistant	<u>6,000</u>
T o t a l	64,400
<b>2. <u>OPERATIONAL COSTS</u></b>	<hr/>
Labor	3,000
Travel	4,000
Service Vehicles (Motor Pool)	4,000
Publications	4,000
Equipment	8,000
Field & Laboratory Supplies	4,000
Supplies & Services	5,000
Maintenance	<u>1,600</u>
T o t a l	<u>33,600</u>
<b>3. <u>LIBRARY SERVICES</u></b>	
Library	<u>4,000</u>
T o t a l	<u>4,000</u>
<b>4. <u>ADMINISTRATIVE EXPENSES</u></b>	
Director's Office, Administration and General Services	<u>18,000</u>
T o t a l	18,000
<b>G R A N D T O T A L</b>	<hr/> <u>120,000</u>

Technical Units/Year: 2



**APPENDIX N°6**

**EDUCATION PROGRAM**

## EDUCATION PROGRAM

There has been a Graduate School at the Center for over 30 years.

It has established its own tradition and the 561 professionals who have received their degrees (527 from Turrialba) --Magister Agriculturae in the first years and Magister Scientiae more recently-- are in the majority holding important positions in the various countries and also in international institutions.

It has been possible to keep fairly accurate track of what the graduates are doing. In Table 1, the number of graduates are listed by the positions they are currently holding. The impact of those who have studied in Turrialba may well be appreciated from this table.

Table 2 presents the graduates, by area of specialization. Specialists in Extension, Economics and Development Resources are no longer trained at the Center. Currently there are only three areas of specialization.

Table 3 summarizes the situation of the graduate students at the school over the past year. This table was elaborated with the aim of indicating the different sources of financing that support the students at the school. As may be noted, the participation of IICA in student training at the Center --although important-- is less so than the Netherlands Government. In addition, there is support from a number of national organisms interested in financing students.

This is indicative of the evident interest in sending professionals to be trained at CATIE's school. It should also be mentioned that some students finance their own studies at the Center.

Table 4 summarizes the total number of students throughout the existence of the school at Turrialba. Of the 2,106 students trained at the Center, 674

were in the graduate program. Five hundred and twenty seven of these have received their M.S. degree.

Due to the basic function of the Graduate School at the Center, particularly with respect to the training of the leaders needed in the countries to assume the responsibility for directing their own agricultural development programs, it is felt that the educational program is deserving of preferential treatment within the diverse programs and activities being carried out at the Center.

TABLE-N°1

Positions held by graduates of the IICA Graduate School (Turrialba, Costa Rica; La Estanzuela, Uruguay, and Bogota, Colombia)  
November 31, 1974

	University Professors	Directors & Specialists of Experimental Stations	Working with Ministries of Agriculture or Planning	Working with Agricultural Development or Promotional Institutions	Private Enterprises	Others	Studying for advanced degrees	Working with International Institutions	T o t a l
ARGENTINA	5	7	1	8	-	2	-	-	23
BOLIVIA	7	1	10	3	1	4	2	4	32
BRASIL	21	23	6	7	1	4	2	3	67
COLOMBIA	23	7	2	18	3	2	3	3	61
COSTA RICA	3	1	11	4	2	2	1	2	26
CHILE	16	-	1	2	-	-	4	1	24
CUBA	-	-	-	-	-	-	-	1	1
ECUADOR	12	8	21	7	4	-	2	11	65
EL SALVADOR	3	1	-	1	-	-	-	1	6
UNITED STATES	2	-	-	1	3	5	1	1	13
GUATEMALA	6	1	1	3	1	-	-	1	13
HAITI	-	-	1	3	4	-	4	6	18
HONDURAS	1	-	-	4	1	1	-	-	7
MEXICO	14	2	2	13	2	14	1	2	50
NICARAGUA	3	-	3	5	1	-	-	-	12
PANAMA	3	-	7	1	1	1	1	-	14
PARAGUAY	2	-	-	-	2	-	-	2	6
PERU	28	5	10	4	8	6	2	5	68
DOMINICAN REP.	4	-	7	2	-	-	2	-	15
URUGUAY	-	4	-	-	-	1	-	-	5
VENEZUELA	6	1	10	3	1	8	1	1	26
OTHER COUNTRIES	3	1	2	2	2	1	-	-	9
<b>T O T A L</b>	<b>162</b>	<b>62</b>	<b>95</b>	<b>89</b>	<b>37</b>	<b>46</b>	<b>26</b>	<b>44</b>	<b>561</b>

TABLE N°2

NUMBER OF PROFESSIONALS WHO RECEIVED THE Magister Scientiae DEGREE

- BY COUNTRY AND BY AREA OF SPECIALIZATION -

(July 25, 1947 through November 30, 1974)

COUNTRY	Exten- sion*	Econo- mics*	Development Resources*	Crops & Soils	Forest Sciences	Animal Husbandry	T o t a l
ARGENTINA	11	-	-	2	1	9	23
BOLIVIA	3	1	1	13	7	7	32
BRAZIL	8	12	9	20	11	7	67
COLOMBIA	7	6	4	23	15	6	61
COSTA RICA	3	1	4	10	6	2	26
CUBA	-	-	-	-	1	-	1
CHILE	2	-	1	10	4	7	24
ECUADOR	10	1	2	36	10	6	65
EL SALVADOR	-	1	-	2	-	3	6
UNITED STATES	3	-	-	6	3	1	13
GUATEMALA	-	2	1	7	1	2	13
HAITI	5	1	-	4	1	7	18
HONDURAS	-	1	2	1	1	2	7
MEXICO	1	-	2	11	6	30	50
NICARAGUA	-	2	2	6	1	1	12
PANAMA	2	1	2	5	1	3	14
PARAGUAY	1	2	-	2	-	1	6
PERU	2	1	-	35	10	20	68
DOMINICAN REP.	-	3	1	5	2	4	15
URUGUAY	-	-	-	-	-	5	5
VENEZUELA	6	3	1	10	3	3	26
OTHER COUNTRIES	-	-	1	7	-	1	9
<b>T O T A L</b>	<b>64</b>	<b>38**</b>	<b>33</b>	<b>215</b>	<b>84</b>	<b>127***</b>	<b>561</b>

\* These three areas of specialization were joined together to form Rural Development.

\*\* Includes 10 students graduated from IICA-CIRA, Bogota, Colombia.

\*\*\* Includes 24 graduates from La Estanzuela. Colonia, Uruguay.

TABLE N°3

NUMBER OF FELLOWSHIPS AWARDED BY DIFFERENT FINANCIAL SOURCES

TO STUDENTS AT CATIE

(July 1, 1973 through June 30, 1974)\*

(Fiscal Year)

Source of Financing	Total	Student/Months
Inter-American Institute of Agricultural Sciences of the OAS (IICA)	41	
Andean Zone	7	74.75
Northern Zone	17	37.75
Southern Zone	2	6.75
IICA-Tropics	6	37.00
Executive Offices	9	31.50 (187.75)
Government of the Netherlands	27	195.00
Government of the Federal Republic of Germany	7	41.00
Organization of American States (OAS)	3	24.00
OAS-PMCA (Short courses)	30	36.50
Food & Agriculture Organization of the United Nations (FAO)	3	29.50
USAID/Recife (Brazil)	1	7.25
Rockefeller Foundation	1	6.00
Personal Financing	11	32.00
National Entities		
Agricultural Credit Bank-Costa Rica	1	1.25
ITCO - Costa Rica	1	1.25
UCR/AID Agreement	2	18.00
Development Bank - Honduras	1	1.25
IDAI/BID/IICA Agreement - Haiti	1	3.00
BID/INIAP - Ecuador	1	8.25
ANUIES - Mexico	1	12.00
CONACYT - Mexico	3	18.00
University of Chihuahua - Mexico	1	1.25
Technical Cooperative Program-Switzerland	2	24.00
MAC-Venezuela	2	18.00
MAC/PRIDA-Venezuela	1	6.00
FONIAP-Venezuela	1	12.00 (124.25)
<b>T O T A L</b>	<b>142**</b>	<b>683.25</b>

\* Includes graduate studies, short courses and in-service training; does not include international seminars.

\*\* Nine of these students received additional support from the Fellowship Rotating Fund of CATIE. Nine students not sponsored by IICA received a complementary married students stipend paid for by IICA.

TABLE Nº 4

NUMBER OF NEW STUDENTS, BY TYPES OF TRAINING RECEIVED

Turrialba, Costa Rica

(IICA-CTEI to June 30, 1973: CATIE since that date)

January 8, 1946 to November 30, 1974

Type of Training	1946-50	1951-55	1956-1960	61	62	63	64	65	66	67	68	69	70	71	72	73	74 TOTALS
Graduate*	25	44	99	24	36	30	28	54	46	99	53	42	48	42	28	3	33** 674
Short courses & Seminars	2	12	409	31	86	15	8	-	11	22	19	25	64	56	49	48	57 914
In-Service Training	--	6	16	8	5	5	3	-	5	5	4	4	3	12	22	16	9 123
Special Students	64	48	46	6	3	7	9	18	11	5	26	11	4	6	22	3	7 296
Vocational Students	47	35	3	3	4	4	-	-	3	-	-	-	-	-	--	-	- 99
<b>TOTALS</b>	<b>138</b>	<b>145</b>	<b>573</b>	<b>72</b>	<b>134</b>	<b>61</b>	<b>48</b>	<b>72</b>	<b>76</b>	<b>71</b>	<b>102</b>	<b>82</b>	<b>119</b>	<b>116</b>	<b>121</b>	<b>70</b>	<b>106 2,106</b>

\* Having received the IICA diploma: 527 (see table re:graduates).

\*\* Graduate students of the IICA-UCR Agreement.