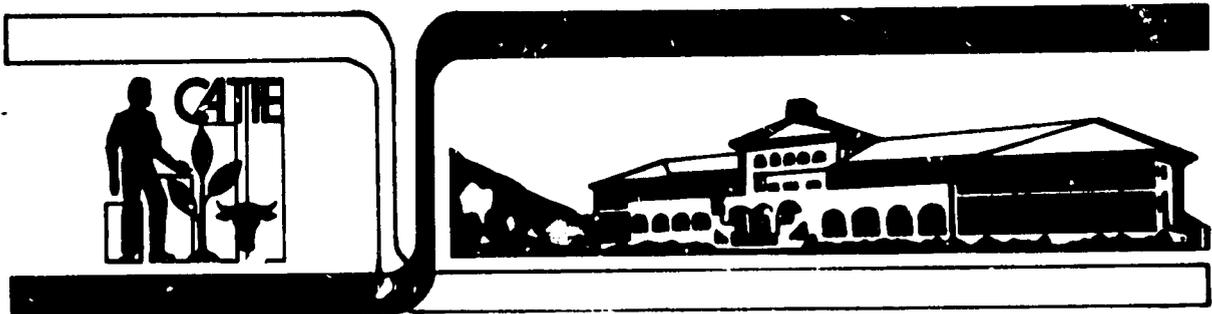


CATIE

TROPICAL AGRICULTURAL RESEARCH AND TRAINING CENTER

STRATEGIES FOR A JOINT EFFORT

to help small farmers of
the Central American Isthmus
to increase food production.



File D-109 6/1/79

TURRIALBA, COSTA RICA
JANUARY 1980

TROPICAL AGRICULTURAL RESEARCH AND TRAINING CENTER, CATIE.
Strategies for a joint effort, to help small farmers of the
Central American Isthmus to increase food production. CATIE,
Turrialba, Costa Rica. 1980. **25** p.

© 1980 Tropical Agricultural Research and Training Center, CATIE.
P. O. Box N° 74
Turrialba, Costa Rica.

CATIE

TROPICAL AGRICULTURAL RESEARCH AND TRAINING CENTER

STRATEGIES FOR A JOINT EFFORT

to help small farmers of
the Central American Isthmus
to increase food production.



TURRIALBA, COSTA RICA
JANUARY 1980

TABLE OF CONTENTS

SUMMARY	i
CHARACTERISTICS OF THE RURAL ENVIRONMENT IN THE	
CENTRAL AMERICAN ISTHMUS	1
AN OBVIUS NEED	1
THE AREA, THE SMALL FARMER	1
THE TECHNOLOGY	2
THE NATIONAL INSTITUTIONS AND CATIE: A PERSPECTIVE	
FOR COOPERATION TO IMPROVE SMALL FARMERS' LIVING CONDITIONS	2
THE MANDATE	2
THE OBJECTIVES	2
THE FUNCTIONS	3
Research	3
Training	4
Technical Cooperation	5
INTEGRATE EFFORTS	6
THE STRATEGY	6
A PROPOSAL TO STRENGTHEN THE ACTIVITIES OF ANNUAL CROPS PROGRAM	9
INTRODUCTION	9
BACKGROUND INFORMATION	10
STRATEGY	10
MAIN LINES OF ACTION	11
A. "Development and improvement of cropping systems	
for small farmers in specific environments"	11
Importance and Justification	11
Objectives	11
Methodology	12
B. "Development of methodologies to increase to	
geografic area for which cropping systems	
alternatives can be recommended"	12
Importance and Justification	12
Objectives	13
Methodology	13

C. "Analysis of cropping systems behavior and their response to environment and management factors"	14
Importance and Justification	14
Objectives	14
Methodology	15
ACTIVITIES OF THE PROGRAM NEEDED SUPPORT	16
Justification	16
Human Resources Needed	17
Required Budget	18
TABLES	19

SUMMARY

CHARACTERISTICS OF THE RURAL ENVIRONMENT IN CENTRAL AMERICA

An obvious need:

Population will more than double by the year 2000 in the Central American countries. Food and energy requirements will consequently have to be increased accordingly.

The area, the small farmer:

The six countries of the Isthmus comprise a population of 16 million inhabitants. Of this, 94 percent live on holdings from less than 4 to 35 hectares. Net income per capita ranges from 49 to 172 dollars for farmers in those units.

Low income per capita, poor housing, poor soils, and small holdings describe the conditions of the small farmers.

Under those circumstances, he cannot take risks.

Most food crops are grown in small farms which account for over 70 percent of the staple food consumed in the area.

The technology:

Small farmers produce most of the food in the area; however, technology is not available for them. Most techniques being developed are for farmers having sufficient resources.

NATIONAL INSTITUTIONS AND CATIE:
A PERSPECTIVE FOR COOPERATION
TO IMPROVE SMALL FARMERS' LIVING CONDITIONS

The mandate:

Small farmers represent a large part of the population, have a large impact on food production, live in poor houses, and raise crops on poor soils; no technology is available in accordance with their resources.

CATIE, a civil, non-profit association is conducting research and offers training and technical cooperation in agriculture, forestry and animal production through close coordination with national institutions in the countries of the Central American Isthmus and the Caribbean.

The objectives:

To increase productivity and production of the small farmers toward improving their living conditions.

The functions:

Research on production, taking into account the economic and biological environment, using a systems approach, considering all limiting factors, studying systems used by farmers and utilizing methodologies to develop suitable alternatives.

Proven technologies and methodologies are transferred to national staff and farmers. This has been some of the main results of CATIE's research efforts. Ten alternatives for cropping systems have been produced in different areas to increase net income up to 334 percent with small increases in production costs.

Improved animal systems have resulted in increasing milk and beef production to the benefit of farmers' diet and the economy of the area.

Natural resources are properly managed toward conservation and efficient use. Technologies and methodologies that do this are being transferred to improve certain environmental conditions.

Technical cooperation from different programs provides assistance to all countries in many aspects.

The farm is considered as a unit; systems being promoted are based on this concept and on the socioeconomic environment.

Training, main resource for development. Graduate training is given to professionals of the area within CATIE's philosophy and methodologies. Noticeable demand from the countries is being partly satisfied through short-term training events.

In 1978-79, a total of 45 graduate courses were taught. More than 200 professionals attended.

Short-term training involved over 450 professionals during the same period. It is done through seminars, short courses, in-service training and workshops.

Technical Cooperation is aimed toward strengthening national institutions.

This activity is carried out through agreements signed with the institutions to promote already proven technology. This technology is transferred to the farmer. The training of national counterparts is carried out as part of this activity by getting them involved in the development of technologies at the farmers' level. A direct impact on production, diet and living conditions is achieved. The countries are requesting an increasing amount of services in the use of natural resources and conservation. Assistance is given in milk, beef, cocoa and coffee production in many countries of the region.

Integrated efforts:

To accomplish the main goals of the Center and the countries -improving the small farmers' living conditions.

A PROPOSAL TO STRENGTHEN THE ACTIVITIES OF ANNUAL CROPS PROGRAM

Introduction

CATIE is a regional institution to promote research and to provide training and technical cooperation in close coordination with the national institutions.

To utilize its resources to better advantage, and to avoid duplication of efforts, CATIE works in cooperation with the International Centers. Their findings are used in CATIE's research work at the farm, and feedback from the farmer is provided to the International Centers.

Because of CATIE's regional scope, ample support is being provided to the national institutions. This fact, added to the quality and continuity of the staff which works in the field, with the farmer, is the main reason explaining the demand for assistance from CATIE.

CATIE has a germplasm bank unique in the region which collects, stores, and provides high quality genetic material to the countries.

Cooperation between the national institutions and CATIE is needed if the countries are to cope with the need for doubling food production, maintaining a rational use of natural resources and preserving a good environment for future generations. This cooperation is already functioning. Further demand to solve problems will require strengthening of CATIE's budget.

To help the countries meet such a challenge, increased budget support is needed to establish a permanent group of able professionals which will provide continuity of efforts.

Background information:

About 75 percent of the food production in the Central American Isthmus is in the hands of small farmers. The Annual Crops Program concentrates its efforts on improving traditional cropping systems in accordance with the socioeconomic conditions of the small farmers; uses an interdisciplinary approach; works with the farmer, at the farm; in all the countries of the Isthmus. It carries out activities through research, training and technical cooperation.

Justification:

The goals achieved by the Programs and the increased demand expressed by the countries at all levels, should be considered as sufficient evidence to support the petition for strengthening CATIE's basic staff.

The countries have expressed their support for CATIE's activities in the last meeting of the Ministers of Agriculture. This is considered an honor, although it also represents new challenges and more responsibilities.

Activities of the Program needing support:

The strengthening of the Program, necessary to carry out and fully implement their objectives and to achieve the goals within its main lines of action, will concentrate on the following activities:

- a) research, jointly carried out with the countries, on main lines of the Program,
- b) support for research and extension personnel of the national institutions to carry out their own programs,
- c) support for research, training and technical cooperation activities presently carried out by CATIE's staff.

Human resources needed:

Senior Staff, at high level, is requested in the various disciplines of the Program.

The requested personnel was strategically distributed over the years to complement actual needs of CATIE and that of the national institutions.

The positions requested represent the permanent staff necessary to conduct research, and to provide training and technical assistance according to the projected and increasing needs of the countries.

Budget requirements:

A three-year budget has been prepared to indicate the projection proposed for this period which will be necessary to meet the personnel requirements to cope properly with present and future demands for CATIE's assistance.

The number of personnel will reach a total of 17 by the third year of which 7 will be financed by CATIE's budget and 10 will require extra funding.

The total contribution requested comes to US\$2,482,100. The impact of the additional resources on the total income for the first year represents a six percent.

CHARACTERISTICS OF THE RURAL ENVIRONMENT IN THE CENTRAL AMERICAN ISTHMUS

AN OBVIOUS NEED:

More food and energy for an increasing population

To cope with the food and energy requirements of an increasing population, most countries of the Central American Isthmus will have to more than double their food production and properly program the use and replenishment of their natural resources before the end of the next decade, thereby presenting a dramatic challenge for those involved in rural development.

THE AREA, THE SMALL FARMER: a challenge

The Central American Isthmus is made up of Costa Rica, El Salvador, Nicaragua, Honduras, Guatemala, and Panamá. The population of Central American Countries is about 16 million people and will be more than 35 millions by the year 2000. In 1970 the rural population represented 64 percent of the total inhabitants of which, 76 percent are located in holdings of less than 4 hectares, and 18 percent, in holdings between 4 and 35 hectares; the rest, only six percent, are located in properties over 35 hectares.

The average annual income seems to be correlated to the size of holdings: 49, 172, and 952 dollars per capita, corresponding to less than 4 hectares, between 4 and 35 hectares, and over 35 hectares, respectively.

The low income, added to the small size of the farms, as well as their being located on poor soils, defines and puts the small farmer in a difficult situation which inhibits him from taking risks.

Of the total area devoted to agriculture, farmers with less than 4 hectares, dedicate 60 percent of their land to food crops; those with holdings between 4 and 35, dedicate 41 per cent to food crops; those with properties over 35 hectares, dedicate only 4.2 percent to food crops.

Although not programmed, small and medium-sized farmers of the area are responsible for producing a large percentage of the staple food consumed in the region. About 80 percent of this production comes from these farmers with small holdings, low net income, and poor soils.

THE TECHNOLOGY:

Unsuited to small farmers' socioeconomic environment

Although it is a recognized fact that the small farmers are involved in feeding themselves and a large percentage of the rest of the population, no technology has been developed that suits their particular socioeconomic and biological environment. New ideas and new research are needed to produce solutions which are both technically and culturally acceptable to tropical small farmers to increase production and productivity.

**THE NATIONAL INSTITUTIONS AND CATIE:
A PERSPECTIVE FOR COOPERATION
TO IMPROVE SMALL FARMERS' LIVING CONDITIONS**

Small farmers are a large part of either the total or the rural population; they have a noticeable impact on the staple food consumed in the area either from an animal or plant source; they live in poor houses, crop in poor soils, and the technology to improve their productivity and consequently their standard of living, is negligible.

THE MANDATE:

towards regional coverage to benefit small farmers

CATIE is a civil, non-profit, autonomous association, scientific and educational in nature, established to carry out, promote and stimulate research, and to provide technical cooperation and training in agricultural, animal and forestry production to produce technical alternatives for the regional needs of the small farmers of the American tropics, particularly in the countries of the Central American Isthmus and the Caribbean.

THE OBJECTIVES:

in accordance with the environment, resources, and national

CATIE's objective is to increase agricultural, livestock and forestry production and productivity, especially of the small farmers of the Central American Isthmus, with the purpose of contributing to the improvement of their living standards by making proper use of natural resources within the framework of national policies, in close cooperation with the national institutions.

THE FUNCTIONS:
toward a
systems approach

*Research: for
production

Research to produce an impact on small farms' production and productivity has to take into account both the economic and biological environment. Methodologies capable of contemplating them are needed. By focusing research on a Systems Approach, considering all limitant factors, and studying systems being utilized by farmers, CATIE has developed a methodology that is being proven at the farmers' level, to generate technological alternatives, according with the farmers resources, consequently, easy to adopt. As a result of the research efforts, both methodology and technologies suitable to the environment are generated by close cooperation between CATIE staff and personnel from the national institutions.

Technologies and methodologies developed, after proven are transferred to the farmers and the national staff of the area.

A methodology to do research at the farm level, assistance to develop national programs in cropping systems, and the initial steps to establish a research network in the Isthmus, are some of the main results of CATIE's efforts. Ten alternatives for cropping systems including corn, beans, cassava, squash, pumpkin, sorghum and cowpea, in different combinations, have been developed.

They may produce an increase in the farmer's net income ranging from 66 to 334 percent, with an increase of only 15 to 23 percent in production costs.

Improved crop management and proper land utilization practices are contributing to a better and more efficient use of the small farmers' resources and producing additional income as a result of combining several annual crops. Significant reduction in soil preparation operations, better use of inputs, and the acquisition of additional products such as those coming from perennial plants and trees are other achievements of CATIE's research efforts.

Improved animal production systems have helped, through better crop management, use of tropical legumes and proper grazing practices, to increase farmer's net income. Breeds and crosses have been evaluate and those proven adaptable to tropical conditions have been selected and are being promoted.

CATIE has worked toward the management and conservation of the natural resources. Crop and tree associations significantly contributing to the farmer's net income have been identified. The Forestry Nursery has been renovated to provide material to be included in the research work. The Collection of New Species has been increased, the Latin American Forest Seeds Bank has been promoted. In addition, the development and utilization of wildlife species in several countries have been of noticeable help to the area.

Annual crops, perennial plants, rugged adaptable animals, animal management, wildlands and wildlife management and the socioeconomic factors affecting these systems are all part of the farm; and as such are considered by CATIE's efforts in order to provide proper answer to the farmer's problems.

*Training: main
resource for
development

Training is considered a fundamental tool to promote the methodologies developed in order to reach the target population. For this, a considerable number of professionals have to be trained to extrapolate and multiply the Center's efforts. Personnel from national institutions, who are involved in research, extension and education, are being trained through a long-term Graduate Program and short-term training activities.

There is a recognized need to design methodologies to accelerate training to help satisfy countries' needs. To achieve this, CATIE is making an effort to carry out training activities at different levels, using methods that make it possible to train larger numbers of professionals.

Agricultural engineers, agronomists, researchers, extension agents, technicians, university professors and students, and personnel from intermediate-level educational institutions will be the target of CATIE's training efforts.

In only one year (1977-1978), the staff of the Center gave a total of 45 courses within the Graduate Program carried out through a joint effort between the University of Costa Rica and CATIE. This involved over 200 professionals of the region and other countries in Latin American. The staff also participated in short-term training activities within the six countries of the Central American Isthmus, working together with the staff of the national institutions. These short-term training activities involved 450 professionals

through short courses, seminars, workshops, in-service training and international meetings. Through these efforts, CATIE is contributing substantially to strengthening a regional network of researchers and experts in agricultural development, interested and trained to do research oriented toward the needs and resources of the small farmers of the American Tropics.

*Technical
Cooperation:
toward strength-
ening national
institutions

Technical cooperation activities are carried out to make sure that technologies developed reach the farmers, and that there is a feedback from the farmer to the researcher.

To properly do this, appropriate and efficient methods of transferring technologies also have to be produced.

Technical cooperation activities, carried out through contracts and agreements with the national institutions of the countries, are the basic channels through which suitable technologies can be tested at the farmer's level, working with the personnel of the national institutions. This concentrated action serves as a model with the multiple purpose of transferring technologies to a large mass of farmers and to train personnel and test methods of transference to accelerate the process.

To accomplish such purposes, CATIE has signed contracts and agreements with the national institutions of the countries for the application of technologies, the planning and development of cropping systems, to exchange germplasm, to assist technically credit programs linked to livestock development activities, to promote milk production as part of land colonization projects, to train personnel, to develop agricultural practices and to manage wildland areas. Technical assistance has been given to Panama in the form of research related to livestock production in order to generate and transfer developed alternatives in this field. Many countries have been helped in planning the management of their natural resources, in managing watersheds, management and conservation of hydraulic resources, in development of national parks and in training programs for the conservation of the environment.

INTEGRATE EFFORTS:

- . Systems approach
- . Interdisciplinary team
- . Training and tech. coop.
- . Working with the farmer
- . At the farm level
- . With national institutions

To accomplish the goals of improving small farmer's living conditions, CATIE is using a multidisciplinary team, working in close cooperation with staff from the national institutions, in the farmers' fields, cognizant of the farmers' problems, and with the farmers' active participation in the process of developing alternatives. Research is conducted away from the experiment station using available inputs. Staff from the countries is trained using methodologies developed and proven suitable. Methods of technology transfer are being developed through promoting proven technologies.

THE STRATEGY:

*The programs: four interacting disciplines in the same institution working at Turrialba and at the country level, to carry out research, training and technical cooperation

The Center has the privilege of having the four basic areas of production for rural areas: Animal Production, Annual Crops, Perennial Plants and Natural Renewable Resources.

Altogether, the functions assigned to the Center and the Programs designed to implement them, have made it possible for CATIE to produce a noticeable impact within the important area of production, an action recognized by the support provided by the Ministers of Agriculture of Mexico, the countries of the Central American Isthmus and the Dominican Republic.

CATIE's Programs have a regional projection and their actions are carried out through projects jointly implemented with the national institutions. Activities within the projects are aimed at the

generation of technology, methodologies for transference, training at different levels, and to assist the institutions through technical cooperation actions.

All the Programs carry out initial surveys to find out what are the predominant systems in the area. This survey is used to determine the main limiting factors in the system used by the farmer. Based on these and data on climatic and socioeconomic conditions, alternatives to the farmers' systems are designed. Validation in the farmer's field is the next step. Once validated, transference to the farmer takes place through technical cooperation agreements with national institutions. The Annual Crops Program concentrates its activities in the following areas:

- a. Development and improvement of cropping systems for small farmers in specific environments.
- b. Development of methodologies to increase the geographic area for which cropping systems alternatives can be recommended.
- c. Analysis of cropping systems behavior and their response to environment and management factors.

The Animal Production Program has four main lines of action:

- a. Development of specialized milk production systems.
- b. Development of beef production systems.
- c. Development of dual purpose production systems.
- d. Development of small animals production systems for small farmers.

The Natural Renewable Resources Program carries out activities in:

- a. Wood Production.
- b. Watershed and wildland management
- c. Agroforestry systems

The Perennial Plants Program emphasizes work on:

- a. Development of cocoa production systems.

b. Development of coffee production systems.

c. Multiple cropping perennial plants systems.

Efforts expanded in all these areas will generate technologies, will train people and will produce methods of transferring and evaluating the findings once they reach the main target--the small farmer.

Specific activities are being carried out in all the countries of the Central American Isthmus, and technical assistance is provided also outside the area.

The benefits of joint activities between national entities and CATIE on production, diet, resource conservation, and efficient use of natural renewable resources and inputs are evident. The methodology used is simple, easy to adopt, and applicable to most environments.

Demand for this kind of effort toward developing adequate technologies is increasing.

CATIE's present basic budget will become unsuitable to respond to the challenges of the 80's. Additional support will be needed to cope with it without stretching CATIE's staff beyond the point of reasonable efficiency.

A PROPOSAL TO STRENGTHEN THE ACTIVITIES OF ANNUAL CROPS PROGRAM

INTRODUCTION

CATIE is a regional institution that works to promote research, training and technical cooperation in close coordination with national institutions. It is becoming a leader in the application of new methodologies for agricultural development by using interdisciplinary teams to work toward solving small farmers' problems.

Technical assistance available in different forms and provided by the Center, is in increasing demand.

CATIE also works in cooperation with the International Centers in a effort to better utilize their findings to avoid duplication of efforts or waste of resources.

Because of CATIE's regional scope, ample support is being provided to the national institutions. This fact, added to the quality and continuity of the staff which works in the field, with the farmer, is the main reason explaining the increasing demand for assistance from CATIE.

Examples of this demand are the recently approved projects on watershed and wildland management for Costa Rica and Panamá, whose governments have requested CATIE's assistance. Coffee and cocoa production are also main concerns of the countries, and a recent project financed by the World Bank in Panamá is going to be implemented through CATIE's assistance in that country.

In addition to this, the Center has a germplasm bank, unique in the area, which collects, stores and provides high quality genetic material to supply the needs of the countries.

To respond to the demands of countries that will be responsible for feeding 25 million people by the year 2000, and that will have to create a large number of jobs per country every year to maintain the increasing population, an institution such as CATIE is strongly needed if the continuity of efforts, toward increasing food production and protection of resources, is going to be provided.

To accomplish this, the Center needs increasing budget support in order to establish a permanent team of able professionals in the different areas and programs.

The Programs needing support are described below. The needed personnel and the corresponding budget are also indicated.

BACKGROUND INFORMATION

The food deficit in the Central American Isthmus has posed the challenge of increasing land productivity as well as incorporating new land into production. About 75 percent of the food production of the area is in hands of farmers located on holdings of less than 35 hectares and a large proportion of basic grains are produced in multi-species crop associations. The Annual Crops Program is concentrating its efforts on improving traditional cropping systems in accordance with the socioeconomic conditions of the small farmer by using an interdisciplinary approach, and by working on farmers' land in all the countries of the Isthmus.

From the biological point of view, research is directed towards the measurement of crop response to controllable and uncontrollable factors. Adaptation of species and varieties to environmental conditions, management, and soils as well as to different cropping systems is determined and alternatives are generated and made available to the farmers. Socioeconomic factors influencing the existence, permanence and adoption of cropping systems are considered, and factors limiting production and adoption of technologies that could increase production are defined.

The demand for training national personnel is high, and the national institutions need further support in their training activities at all levels to maintain their efforts in research and technology transfer towards providing the farmers with alternatives to improve their standard of living.

STRATEGY

An interdisciplinary approach to the study of production systems is being implemented through regional research projects. The goal of these projects is the evaluation of the different factors affecting production, emphasizing the study of constraints that when removed, will result in increased production. The effect of the factors on the response variables, and the interrelations among factors, are considered. Cropping management methods are designed and the production potential of species and varieties adapted to specific environments, resulting in reduced cost of production, are studied. Finally, the potential of transferring information obtained from one research site to another by identifying similar climates and soils in different geographic areas and by quantifying the response of crops to different factors is being studied.

Training is considered a fundamental tool to promote the methodologies developed in order to reach the target population. For this, a considerable number of professionals are being trained through the Program's staff to

extrapolate and multiply the Center's efforts. Personnel from national institutions, who are involved in research, extension and education, are being trained through a Graduate Program and short-term training activities. Using different training methods, the target population will be increased in the future.

MAIN LINES OF ACTION

A. "DEVELOPMENT AND IMPROVEMENT OF CROPPING SYSTEMS FOR SMALL FARMERS IN SPECIFIC ENVIRONMENTS"

Importance and Justification

Approximately 94 percent of the farms in Central America are under 35 hectares. These farms produce about 70 percent of the total food consumed in the area. Small farms occupy much of the land used for food crops. These crops are grown using a technology that requires little capital, which is normally unavailable. Most of the farm activities are dependent on family labor, chemicals and machinery are seldom used, and production systems are based on low energy consumption and on a very efficient use of this energy.

These farmers are normally located far from important markets and their farms have poor soils or have some important limiting factors to production. In many instances, the climatic conditions create a high-risk environment for crop production. Because of these factors the use of higher technology is less suitable than the technology presently used by the farmers. The systems used by the farmer must be identified to be able to improve or to produce alternatives. The conditions under which small farmers produce food crops, their crop production systems and their management practices are beginning to be understood. Their production systems however, include a number of complex interrelations. Because of this complexity, a systems methodology must be developed.

Appropriate low cost and low risk technology which allows the farmer to more efficiently use his scarce resources and increase his income must be generated. The capacity to do cropping systems research in the countries is also necessary as one step toward the regionalization of agricultural research.

Objectives

To acquire knowledge about the farmers' cropping systems and the relationship of these systems to the biological and socioeconomic factors in specific areas. This information can be used to produce alternatives which make better use of the available resources and energy which are relatively independent of expensive sources of energy or inputs, and which yield increased economic benefits.

To identify species and varieties of crops suitable to be incorporated in the systems in specific areas.

To analyze the socioeconomic factors affecting different cropping systems, the effect of these factors on the management of the crops, and the role of the cropping systems within the farm.

To develop methodologies for designing cropping systems for specific environments.

Methodology

Research is carried out in areas where small farmers are concentrated within the Central American Isthmus, in cooperation with staff of the national institutions of the region, through the following activities:

- 1.- Surveys to identify factors limiting production of the principle crop systems of the area, design of research programs for managing and studying the limiting factors, experimentation to produce alternatives, and validation and adjustment of alternatives are carried out on each site.
- 2.- A diagnostic study of the soils, climate and socioeconomic factors of the area is carried out. The principle production systems are identified and their management, the type of technology used, and their effect on the whole farm are determined. Limitations to production and available resources are determined.
- 3.- Production systems making a better use of resources or more adapted to limiting conditions are studied on the farmers' land and with the farmers' active participation. The data gathered are used to design alternative systems which take management characteristics into consideration and have an economic advantage over the traditional systems, as well as a beneficial effect on the diet of the farmer and on resource conservation.
- 4.- Training and technical assistance are carried out to transfer results and methodologies to the staff of the national institutions.

B. "DEVELOPMENT OF METHODOLOGIES TO INCREASE THE GEOGRAPHIC AREA FOR WHICH CROPPING SYSTEMS ALTERNATIVES CAN BE RECOMMENDED"

Importance and Justification

One characteristic of agriculture is its dependence on climate, soils, and socioeconomic conditions. While marketing is also a factor affecting the type of crops chosen by the farmers, small farmers have little influence on market decisions.

The environmental variability within the Central American countries impairs the progress of agriculture in that it makes it difficult to extrapolate results between geographic areas. Site specific research and experimentation is necessary; however, the results of this type of research cannot be directly transferred to other areas.

To increase the geographic impact of agricultural research a better knowledge of the environments of Central America and of the response of different cropping systems to these environments is necessary. This requires the gathering and organization of all available information for each area within the region. Climatic and soil information and its agricultural implications is one of the first needs. This knowledge can be used to determine representativity of specific sites and will allow the selection of agriculturally important areas within the region. All this information will allow the objective selection of research sites.

Climatic data from the six countries is currently available; however, some of the data is unreliable. Most of this information was gathered for statistical purposes and has not yet been analyzed to determine its usefulness for agricultural purposes. Good information on soil classification is available for El Salvador, Nicaragua, and Honduras. Data are also available on chemical soil properties although correlation with crop response has not been determined.

Objectives

To identify and characterize the geographic areas from the point of view of climate and soils, emphasizing areas where small farmers are concentrated.

To study soils and determine the relationship between laboratory and/or greenhouse studies and crop performance in the field.

To develop methodologies to study the relationship between environmental factors in different geographic areas and cropping system performance.

To determine similarities among environments and to analyze the advantages and disadvantages of different methods used to establish these similarities.

To study relationships between environment and cropping system performance to accelerate research and technology adoption.

Methodology

Work is done in cooperation with the institutions engaged in generating information on climate and soils in the countries as well as with national agricultural research institutions, through the following steps:

- 1.- Definition of which climate, soils, and ecological data are needed.
- 2.- Inventory of useful existing information and the design of the methods to use and analyze the data.

- 3.- Obtain needed complementary data through cooperating institutions.
- 4.- Design methodologies to measure environmental similarities.
- 5.- Establish system performance prediction and inference functions.
- 6.- Design and carry out field experiments or tests to validate the methods used.
- 7.- Make needed methodology adjustments depending on the goals achieved and on the need for more precision.

C. "ANALYSIS OF CROPPING SYSTEMS BEHAVIOR AND THEIR RESPONSE TO ENVIRONMENT AND MANAGEMENT FACTORS"

Importance and Justification

In order to generate and transfer cropping systems recommendations between geographic areas, the environment, the system, and the environment-systems relationship must be understood. Only fragmentary information is presently available regarding climatology, soils and ecology. Some data are available from experiments where crop response was measured as management factors were changed.

In designing new cropping systems, it is necessary to find out how the system behaves in a specific environment and how the system responds to the combined or individual effect of a factor or group of factors.

The purpose of this line of research is to develop the ability to design cropping systems management practices for environments whose physical and biotic characteristics are known. Since it is not possible to test all possible cropping systems and management in combination with every climate and soil, some guiding principles and relationships between environmental factors and systems response are necessary. These principles will permit inferences about systems not previously tried in the area and, increase the likelihood of adoption by farmers.

Objectives

To study the relationship among environment, management factors and cropping system response.

To study the effect of the interaction among several environmental factors on cropping systems.

To determine the most favorable environmental conditions for different cropping systems and to find the range of acceptable performance.

To develop adequate crop management practices that take into account the effect of controllable factors on the systems and to identify interaction between management practices and the environment.

To develop management practices which either correct or take advantage of environmental conditions.

To determine the interaction among crops that are components of multi-species cropping systems, and the effect of different environments, and management practices on this interaction.

To identify, evaluate, and select species and varieties according to their adaptation to specific climatic and management conditions, emphasizing their adaptation to being planted in association with other crops.

To transfer research results and potential methodologies to the national institutions.

Methodology

Several lines of research with many starting points are necessary in order to integrate available data and generate cropping system recommendations to other researchers. At a later stage, recommendations for extension agents will be generated and the research methodology, once adjusted and improved, will also be made available.

- 1.- The influence of important environmental factors will be studied to determine their effect on the cropping systems. The range of acceptable performance variation will be established for selected cropping systems. Crop competition and factors affecting the competition will be also studied.
- 2.- Based on this information, crop management practices will be tested in order to identify those which allow higher yields on sustained basis, making efficient use of energy and of costly or difficult-to-obtain inputs.
- 3.- Specific information generated in other areas in the tropics will be reviewed and analyzed. Experiments will be carried out in Turrialba and in cooperating countries with the farmers, in their plots, as well as in experiment stations.
- 4.- Genetic material collected in the countries and from national and international centers, which might have potential under certain specific conditions, will be evaluated with regards to yield stability and adaptation to the environment and small farmers' management practices.

ACTIVITIES OF THE PROGRAM NEEDED SUPPORT

The strengthening of the Program necessary to carry out and fully implement its objectives and to achieve the goals within the main lines of action mentioned above, will concentrate on the following activities:

- a) research, jointly carried out with the countries, on the main lines of the Programs,
- b) support for research and extension personnel of the national institutions to carry out their own programs,
- c) support for research, training and technical cooperation activities presently carried out by CATIE's staff.

Support for these activities is needed to ensure that the national institutions will be able to implement their own programs in the future; to train their staff, following CATIE's philosophy, to identify and evaluate problems, to assign priorities in decision making, and to make sure resources and efforts will be directly channelled toward the development plans of each individual country. To do this, CATIE needs to increase the number of basic staff to provide the additional support needed to carry out cooperative activities among researchers and extension specialists, and to backstop projects related to CATIE's research objectives which are all to be based on a common goal - improving the living conditions of the small farmers. Once the needed support is obtained, CATIE's position and credibility, gained by projecting its efforts towards the countries, by working with the staff of the national institutions, and with the farmers, will permit the Center to project further its influence and actions at the regional and national levels. The regional action of the Center will avoid overlapping of efforts among countries with the consequent saving of human and monetary resources, and will be independent of political fluctuations.

JUSTIFICATION

The goals already achieved by the Program individually and by all CATIE's activities using a multidisciplinary approach regarding farming systems, should be considered as sufficient to justify the request for funding to support basic staff requirements.

Most of the research results obtained for the main lines of the Program will be applicable within the next five or ten years. It then becomes obvious that there is a need for adequate human and physical resources to guarantee stability of CATIE's projections, the validity of its research and the adjustment of the methodologies developed, as well as to provide permanent assistance to the national staff of the countries.

There is an obvious need to learn more about cropping systems; on their role in the farm and ways to increase efficiency in the use of management practices and inputs. This has to be done if we are to cope with the challenge of doubling food production before the end of this decade.

Activities carried out through the Program enable CATIE to produce suitable alternatives for the region through extrapolating research results from one site to other similar areas, avoiding then the duplication and waste of efforts and other limited resources, by providing proper coordination among researcher and extension agents of the different national institutions.

The projection given to the Center through its innovative approach to development, applied during the last few years, has created an increasing demand on the services of the present personnel. The support provided by the Governments of the area constitutes an honour for the Center, but also an additional challenge and responsibility for the institution.

It is the intention of the Program, as well as that of CATIE in general, not to stretch its existent manpower beyond the point of reasonable efficiency. To further extend activities and to better support present operations, the Program and the whole Center must have solid support of a highly qualified staff. Additional and stable budget support is needed to achieve the required staff; acquire the needed equipment and obtain research inputs.

HUMAN RESOURCES NEEDED

To continue efforts already initiated, there is a need for the Senior Staff presented in Table 1. This staff will consist of high level professionals in the various disciplines of Annual Crops.

The staff will be located at Turrialba headquarters and will cooperate more closely with the national institutions; a considerable number will be located in each country.

The total number of required personnel has been strategically distributed over the years to respond strictly to activities having priority and to complement the actual staff of CATIE and that of the national institutions. To determine the needs, both CATIE's personnel and national staff were considered.

Requirements for the first year call for a Cropping Systems Specialist, a Production Specialist, a Farm Management Specialist and a Training Coordinator. The Cropping Systems Specialist will provide the necessary assistance to accomplish the integration of information generated relative to the components of systems. The Crop Production Specialist will be needed to increase the capacity for understanding the management of entire cropping systems, and also to facilitate the integration of knowledge in this area within more productive farming systems. The Farm Management Specialist will join him in these efforts. The Training Coordinator will arrange educational activities to be carried out by members of CATIE's technical staff.

The second year will require the services of a Specialist in Soil Fertility and an Agronomist to reinforce areas of great importance for the national institutions.

For the third year, plans call for an Agricultural Economist to collaborate in the integration of activities in the area.

Increased demands for farming systems research predicted for this year will require the services of a Crop Physiologist to reinforce the research on crops systems behavior, giving emphasis to studies on crop competition and adaptability to specific environments, working in close cooperation with plant breeders, in multi-cropping situations.

REQUIRED BUDGET

A three-year budget has been prepared to indicate the projection proposed for this period which will be necessary to meet the personnel requirements to cope properly with present and future demands for CATIE's assistance.

In Tables 1-7, the total and additional budgets needed by the Program are shown. Personnel, materials, and equipment are also included. The Tables also show an analysis of the present and proposed budgets for three years.

Table 1 indicates the total Program Senior Staff and additional staff funding required. There are 11 required for the first year (4 additional and 17 for the third year, representing 10 new positions). All personnel costs include benefits and allowance, as well as social security costs.

Table 2 shows personnel costs support personnel costs, as well as other support costs.

The total contribution requested for the first year amounts to US\$639,100, and for the three-year period, it comes to US\$2,482,100 (Table 3).

The proposed situation (Table 4), regarding the percentage of the total Program resources represents a change from 16 to 32 percent for the first year.

Regarding the impact of the additional resources on the total income for the first year (Table 7), it only represent six percent.

TABLE N^o 1. CATIE, ANNUAL CROPS PROGRAM. REQUIRED BASIC PROFESSIONAL STAFF AND COSTS FOR THE NEXT THREE YEARS.

(THOUSANDS OF 1930 US DOLLARS)

Position	Academic Level	First Year	Second Year	Third Year	Total
1. Program Head	PhD.	41.0	44.0	46.0	131.0
2. Plant Physiologist	PhD.	35.0	37.0	39.0	111.0
3. Plant Pathologist	PhD.	38.0	41.0	43.0	122.0
4. Cropping Systems Specialist	PhD.	36.0	38.0	40.0	114.0
5. Crop Systems Breeder	PhD.	38.0	40.0	42.0	120.0
6. Associate Plant Breeder	M.S.	36.0	39.0	41.0.	116.0
7. Soil Management Specialist	PhD.	37.0	40.0	42.0	119.0
8. Horticulturist	PhD.	34.0	38.0	40.0	112.0
9. Crop Production Specialist	PhD.	30.0	38.0	40.0	108.0
10. Crops Systems Specialist	PhD.	27.0	38.0	40.0	105.0
11. Farm Management Specialist	M.S.	25.0	36.0	38.0	99.0
12. Soil Fertility Specialist	PhD.		45.0	38.0	83.0
13. Associate Training Officer	M.S.		43.0	36.0	79.0
14. Agronomist	M.S.		43.0	36.0	79.0
15. Plant Protection Specialist	PhD.		45.0	38.0	83.0
16. Agricultural Economist	PhD/M.S.			45.0	45.0
17. Crop Physiologist	PhD.			45.0	45.0
ADDITIONAL FUNDING REQUIRED		(116.0)	(326.0)	(396.0)	(838.0)
TOTAL BASIC PROFESSIONAL STAFF COSTS		377.0	605.0	689.0	1,671.0
TOTAL SENIOR STAFF POSITIONS		11	15	17	

19

TABLE N^o 2. CATIE, ANNUAL CROPS PROGRAM. SUPPORTING COST OF BASIC PROFESSIONAL STAFF,
FOR THE NEXT THREE YEARS.

(THOUSANDS OF 1980 US DOLLARS)

Description	First Year	Second Year	Third Year	Total
PERSONNEL	255.8	336.8	411.3	1.003.9
TRAVEL AND PERDIEM COSTS	38.6	47.0	55.4	141.0
EQUIPMENT AND COMMODITIES	89.9	58.7	51.3	199.9
COMMUNICATION COSTS	23.6	29.5	34.8	87.9
MAINTENANCE & OPERATION COSTS	77.3	30.0	33.5	140.8
SPECIFIC INPUTS	51.9	54.4	58.0	164.3
ADMINISTRATIVE AND LOGISTIC SUPPORT	124.4	134.9	146.4	405.7
GENERAL COSTS	20.0	--	--	20.0
TOTAL STAFF SUPPORT COSTS	681.5	691.3	790.7	2.163.5

TABLE N^o 3. CATIE, ANNUAL CROPS PROGRAM. SUMMARY OF PROJECTED BASIC COSTS, BY CATEGORY AND SOURCE, FOR THE NEXT THREE YEARS.

(THOUSANDS OF 1980 US DOLLARS)

Description	First Year	Second Year	Third Year	Total
BREAKDOWN BY CATEGORY				
1. Senior staff costs	377.0	605.0	689.0	1.671.0
2. Staff support costs	681.5	691.3	790.7	2.163.5
TOTAL	1,058.5	1,296.3	1,479.7	3,834.5
BREAKDOWN BY SOURCE				
1. CATIE available resources	419.4	451.6	481.4	1,352.4
2. Additional resources required	639.1	844.7	998.3	2,482.1
TOTAL	1,058.5	1,296.3	1,479.7	3,834.5

21

TABLE N^o 4. CATIE, ANNUAL CROPS PROGRAM. TOTAL PROGRAM RESOURCES PRESENT AND PROPOSED SITUATIONS, FOR THE NEXT THREE YEARS.

(THOUSANDS OF 1980 US DOLLARS)

Description	First Year		Second Year		Third Year		Total	
	US\$000	%	US\$000	%	US\$000	%	US\$000	%
PRESENT SITUATION								
1. Basic activities - CATIE resources	419.4	16	451.6	15	481.4	15	1.352.4	15
2. Contracts & specific agreements	2.285.4	84	2.474.6	85	2.672.5	85	7.432.5	85
TOTAL	2.704.8	100	2.926.2	100	3.153.9	100	8.784.9	100
PROPOSED SITUATION								
1. Basic activities - CATIE + additional	1.058.5	32	1.296.3	34	1.479.7	36	3.834.5	34
2. Contracts & specific agreements	2.285.4	68	2.474.6	66	2.672.5	64	7.432.5	66
TOTAL	3.343.9	100	3.770.9	100	4.152.2	100	11.267.0	100

22

TABLE Nº 5. CATIE, ANNUAL CROPS PROGRAM. RELATIONSHIP BETWEEN BASIC RESOURCES AND FUNDING FROM SPECIAL PROJECTS; PRESENT AND PROPOSED.

(THOUSANDS OF 1980 US DOLLARS)

Description	PRESENT		PROPOSED	
	US\$000	%	US\$000	%
1. Gross basic income	2.897.6	29	3.453.3	33
2. Contracts & agreements	7.170.7	71	7.170.7	67
TOTAL	10.068.3	100	10.624.0	100

23

TABLE N° 6. CATIE, ANNUAL CROPS PROGRAM. REQUESTED ADDITIONAL FUNDING EXPRESSED AS A PERCENTAGE OF TOTAL BASIC BUDGET FOR 1980.

(THOUSANDS OF 1980 US DOLLARS)

Description	US\$000	%
1. CATIE available gross basic income	2.897.6	82
2. Additional resources required	639.1	18
TOTAL	3.536.7	100

CUADRO N° 7. CATIE, ANNUAL CROPS PROGRAM. REQUESTED ADDITIONAL FUNDING EXPRESSED AS A PERCENTAGE OF CATIE'S TOTAL BUDGET FOR 1980.

(THOUSANDS OF 1980 US DOLLARS)

Description	US\$000	%
1. CATIE total 1980 available income	10.068.3	94
2. Additional resources required	639.1	6
TOTAL	10.707.4	100

24

TABLE N° 8 . CATIE, GLOBAL BUDGET SUMMARY 1980.

(THOUSANDS OF 1980 US DOLLARS)

Description	US\$000
1. Direction	101.7
2. Technical Coordination	155.3
3. Programs	
3.1 Annual Crops	2.704.8
3.2 Perennial Plants	516.8
3.3 Animal Production	2.129.3
3.4 Natural Renewable Resources	2.147.4
4. Technical support units	916.8
5. Administration and services	593.4
6. Farm operations	371.8
7. General costs	431.0
TOTAL	10.068.3