

C A T I E

CENTRO AGRONÓMICO TROPICAL DE INVESTIGACIÓN Y ENSEÑANZA

Plant Production Department

// TRAINING FOR AGRICULTURAL RESEARCH AND  
TECHNOLOGY DEVELOPMENT IN CATIE

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## ACRONYMS

AID	Agency for International Development, United States
CATIE	Centro Agronómico Tropical de Investigación y Enseñanza Tropical Agricultural Research and Training Center
CEI	Centro de Enseñanza e Investigación Center for Training and Research
CTEI	Centro Tropical de Enseñanza e Investigación Tropical Center for Training and Research
CENTA	Centro Nacional de Tecnología Agrícola National Center for Agricultural Technology, El Salvador
DDA	Swiss Program of Cooperation for Development
EEC	European Economic Community
FSR	Farming System Research
IBM	International Business Machines
ICTA	Instituto de Ciencia y Tecnología Agrícolas Institute for Agricultural Sciences and Technology, Guatemala
IDA	Instituto de Desarrollo Agrario Institute of Agricultural Development, Costa Rica
IDB	International Development Bank
IDIAP	Instituto de Investigaciones Agropecuarias de Panamá Agricultural Research Institute of Panama
IDRC	International Development Research Centre, Canada
IFAD	International Fund for Agricultural Development
IICA	Instituto Interamericano de Cooperación Agrícola Interamerican Institute for Agricultural Cooperation, Costa Rica
ITCR	Instituto Tecnológico de Costa Rica Technological Institute of Costa Rica
MAG	Ministerio de Agricultura y Ganadería Ministry of Agriculture and Animal Science, Costa Rica
MIDINRA	Ministerio de Desarrollo Integral y Reforma Agraria Ministry of Integrated Development and Agrarian Reform, Nicaragua

OAS      Organization of American States  
ODA      Overseas Development Administration, United Kingdom  
PPD      Plant Production Department  
SFPS     Small Farm Production Systems  
UNU      United Nations University

TRAINING FOR AGRICULTURAL RESEARCH AND  
TECHNOLOGY DEVELOPMENT IN CATIE\*

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INTRODUCTION

This document was prepared in response to an invitation by the Association of Caribbean Universities and Research Institutes (UNICA), to present the efforts of CATIE for training professionals in agriculture within its mandate region.

Particular attention is given, in the presentation, to what CATIE is doing through training to promote the use of an approach, which requires the interaction of agricultural researchers and agricultural extensionists, for developing technologies which are appropriate to improve the main production systems employed by important groups of farmers in well defined circumstances. This might appear as redundant since it could imply to work in what is obvious and should be happening. However, the well documented problems of coordination and effectiveness of the different institutions which constitute the mechanisms for developing agricultural technologies in different countries of Latin America, makes these efforts highly necessary ( 9 ).

Several reasons have been pointed out to explain the present deficiencies in the institutional mechanisms for technology development at country

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level; among them CATIE has been concentrating in two, within the scope of its mandate and capabilities. They are: a) the methodologies used at institutional level for developing agricultural technologies and b) the capability and training of personnel using them.

It should be recognized, from the outset, that what CATIE has developed in this respect resulted from the experience gained by facing the present institutional situation while trying to meet its mandate and commitments associated with specific research and technology development projects (7). Therefore, this is presented more as a case study than as a general recommendation. However, the main lessons and insights gained could be of interest for people concerned with evaluating in a permanent manner the structure, resources, orientation and methodology of national institutions, particularly those in agricultural research, agricultural extension and training in agriculture.

This document is structured to present first CATIE as an institution and its background in training of agricultural professionals. In a second part, the main characteristics and background of its working methodology, in relation to technology development will be presented; then several aspects related to the structuring, orientation and advances in demonstrating the operability of the method and training national personnel in its use will be discussed. Finally, the main implications and lessons provided by this experience for future training of agricultural professionals at national level and by CATIE will be set forth.

This is not an official presentation for CATIE and all opinions are responsibility of the author.

#### CATIE'S MANDATE AND ACTION FRAMEWORK

CATIE is the "Tropical Agricultural Research and Training Center" located in Turrialba, Costa Rica. Its mandate includes research, training and technical cooperation in crop production, animal production and forestry within the tropical region of America with focus on the Central American and Caribbean sub-regions.

CATIE was founded in 1973 as an association between IICA, the specialized agricultural body within the OAS, and the Government of Costa Rica. The Dominican Republic, Honduras, Guatemala, Nicaragua and Panama have also become partners in the association; the membership of El Salvador and other countries are being studied.

The priority for CATIE's orientation and focus toward the "Small Farm Sector" of its mandate region was identified by the member countries in 1973 (5). Small farmers, of less than 4 ha and with 4 to 35 ha accounted for 76 and 18% of the Central American rural population respectively, and half of the total 20 million people in the region. Their resources, low in quality, amounted to only one fourth of the total farm land and less than one fifth of the total farm input expenditure, while their per capita income was under US\$100 per year. They provide, however, two thirds of the total active rural labor force and over two thirds of the value of the

food crops produced for the region, excluding rice. Their participation in rice, perennial crops and livestock production, part of which the region exports, amounted to 36, 39 and 21% of their total production value respectively. Given the forecast for the next twenty years in terms of population growth, economic expansion and energy costs, the "Small Farmers" will continue to be one of the most important social and economic sectors in the region (3).

Most of CATIE's activities are developed through and in cooperation with the national research and extension institutions across the different countries of its mandate region. This interaction should contribute to strengthen those institutions by stimulating a better use of existing capabilities in CATIE and the exchange of knowledge and expertise among countries.

CATIE operates with a staff of almost one hundred fifty professionals in different fields of agriculture, one third of them expatriate, and a budget of about ten million dollars per year. Most of the budget is accounted for by specific agreements and projects financed by AID, DDA, EEC, IBM, IDB, IDRC, IFAD, GTZ, ODA, UNU, Kellogg Foundation and the Government of Holland; IICA and the member governments provide the core budget (2).

At its headquarters in Turrialba, CATIE houses the oldest graduate school and one of the principal libraries in agriculture (Orton) for Latin America.

Three research departments (Crop Production, Animal Husbandry, Natural Renewable Resources) and one support department (Resources for Research and Training) allow the present outreach work of CATIE.



Today, CATIE is better known across its mandate region because of:

a) its focus on the small farmers' sector of agriculture and b) the promotion and training for the use, by researchers and extensionists at national level, of an on-farm multidisciplinary approach to develop technologies which are appropriate for improving the technical and economic performance of selected production systems which are used by small farmers.

#### CATIE's EXPERIENCE IN TRAINING PROFESSIONALS IN AGRICULTURE

The headquarters of CATIE were initially installed on the infrastructure previously used by IICA in Turrialba, Costa Rica. Being an associated institution, CATIE has also inherited part of its mandate and experience, particularly in training, from IICA. Such experience in training dates back to 1946 when the first graduate school in agriculture was founded, to serve the member countries and as part of the training responsibilities of IICA. In 1960, the headquarters of IICA moved to San José, Costa Rica and a specialized body for training was created as part of the Institute, under the name of Center for Training and Research (CEI) which continued operations in Turrialba and until 1969. In 1970 this specialized body took the name of Tropical Center for Training and Research (CTEI) which maintained an emphasis in the training of professionals in agriculture and until 1972. In 1973 the emphasis changed to research when the Tropical Agricultural Research and Training Center (CATIE) was created and in considerau



tion of the fact that several other graduate schools were already active in different countries of the mandate region for IICA. The graduate school at Turrialba provided the degree of Magister Agriculturae until 1962, and the Magister Scientiae since 1963. It operates today under an agreement between CATIE and the University of Costa Rica.

Besides the graduate school, the Center in Turrialba has provided other forms of professional training, including: in-service training, short courses, seminars, workshops and the guidance of special students.

The training provided by the Center has given emphasis to different disciplines or aspects related to agricultural production, animal husbandry and forestry as well as to different supportive disciplines such as agricultural extension and agricultural economics, during different periods.

The target group for the training provided by the Center has been the professionals working in research, training or extension in the different fields of agriculture across the member countries.

Tables 1 and 2 contain a summary of the coverage by disciplines, country of origin for the students and by the type of training provided throughout the different periods by the Center at Turrialba. They also show the increased emphasis over time, given to professionals from the Central American and Caribbean regions.

The topics of training have also been modified during the 1974-1983 period to provide greater emphasis to the methodological aspects of research for technology development. This has occurred while CATIE has been gaining experiences in this respect, through its outreach work, across the Central

Table 1. Number of M.Sc. degrees provided by field of emphasis, origin of the students<sup>2/</sup> and periods; at the Training Center in Turrialba, 1946 - 1983.

Time Period	No. of Students by origin <sup>2/</sup>						
	Field	No.	C. Am.	S. Am.	N. Am.	Carib. Other	
1946 - 1973 IICA/CEI/CTEI	Ag. Extension	63	5	50	4	4	--
	Ag. Economics	38	8	27	4	4	
	Resources						
	Development	34	11	18	2	2	1
	Tropical Crops						
	and Soils	225	33	157	18	10	7
	Forestry Science	86	10	62	10	4	--
	Tropical Animal						
	Husbandry	126	15	69	29	11	2
	SUB-TOTAL (%)	572	82(14)	383(67)	63(11)	34(6)	10(2)
1974 - 1983 CATIE/UCR <sup>3/</sup> completed degrees	Plant Production	63	25	30	1	6	1
	Natural Renewable						
	Resources	30	12	18	0	0	0
	Animal Production	43	16	17	7	3	0
	SUB-TOTAL (%)	136	53(39)	65(48)	8(6)	9(7)	1(0)
	Plant Production	33	23	5	4	1	0
1979 - 1983 CATIE/UCR <sup>3/</sup> pending	Nat. Renew. Resources	24	16	5	0	2	1
	Animal Production	16	9	5	2	0	0
	SUB-TOTAL (%)	73	48(66)	15(21)	6(8)	3(4)	1(1)
	GRAND TOTAL (PERCENTAGES)	781	183(24)	463(59)	77(10)	46(6)	12(1)

1/ Over 95 percent of students are accounted as researchers working in experimental stations, teaching at the university level or as agricultural extensionists within the respective Ministry of Agriculture.

2/ C.Am., Central American Isthmus; S. Am., South America; N. Am., North America; Carib., Caribbean region

3/ The graduate school operates under an agreement of CATIE and the University of Costa Rica (UCR).

SOURCE: Unpublished reports of the Training Unit of CATIE.

Table 2. Number of trainees by type of non degree training<sup>1/</sup> and periods at the training center in Turrialba, 1946- 1983.

Time Period	Training		Observations
	Type	No. (%)	
1946 - 1973 IICA/CEI/CTEI	In-Service	205 (17)	27% from the Central American and Caribbean regions
	Short Courses	608 (50)	
	Seminars/Workshops	104 (9)	
	Special Students	290 (24)	
	SUB-TOTAL	1207 (100)	
1974 - 1979 CATIE, only at Turrialba	In-Service	103 (13)	Over 60% from the Cen- tral American and Ca- ribbean region
	Short Courses	463 (57)	
	Seminars/Workshops	214 (27)	
	Special Students	23 (3)	
	SUB-TOTAL	804 (100)	
1980 - 1983 CATIE, in Turrialba and at country level	In-Service	211 (6)	70% from the Central American and Caribbean regions
	Short Courses	2579 (76)	
	Seminars/Workshops	582 (17)	
	Special Students	4 (1)	
	SUB-TOTAL	3376 (100)	
	TOTAL	5387	

<sup>1/</sup> Beginning in 1976, an increasing proportion of the non degree training events have been on methodological and disciplinary topics related to the systems approach to research and technology development in the different fields of agriculture.

SOURCE: Unpublished reports of the Training Unit of CATIE.

American Isthmus which began in 1975 with the implementation of a regional research project.

#### THE TECHNOLOGY DEVELOPMENT STRATEGY PROMOTED BY CATIE

Beginning in 1973 CATIE focused part of its research activities on the study and technical improvement of the crop production systems used by the small farmers of the Central America region.

The scientists at CATIE realized that they knew little about the crop production systems used by small farmers in the region and about methods to improve them technically. Appropriate literature was also scarce and scattered. Thus they were forced into a period of self training.

They initiated an experiment on plots at the Turrialba experimental station, in order to learn the management and test the productive potential of various crop systems, chosen to simulate some of those found on small farms. Soon they acknowledged the need to approach the farmers directly to find out that they were really doing, how and why. They visited farmers and some experimental plots were installed on selected farms or on experimental fields of Agriculture Schools in different communities of Costa Rica.

The approach to the farmers was found crucial in understanding the present crop production systems, their objectives within the farms and their main limitations according to those objectives. A procedure for identifying and justifying appropriate lines of research was thus emerging. Later the experience was enriched through contacts and exchanges with IRRI in the Philippines and the "Puebla Project" in Mexico.

During this time AID has also developed a keen interest for research strategies which could benefit small farmers. Thus in 1974, AID through ROCAP, its regional office, helped CATIE to hold in Turrialba a regional conference to explore the dynamics and possibilities for cropping systems research (1). Later, ROCAP and CATIE formalized the Small Farmer Cropping Systems Project (SFCS) for implementing during 1975-1979. This project would be used to reinforce the emerging ideas at CATIE and to attempt their implementation across the different countries of the region, through strict interaction with personnel from the national research institutes.

The primary purpose of the SFCS project was to create a coordinated regional research approach for increasing the productivity and incomes of small farmers in Central America through improved cropping systems. The project would be implemented through research on cropping systems carried out in the fields of small farmers, across the countries of the region and by multidisciplinary teams of national research professionals with the support of CATIE's personnel.

To accomplish the objectives of the Project, CATIE had to reach agreement with every participating country on a program of activities including close collaboration with the national institutions. This implied an expectation for counterpart personnel and research resources from every country.

Eventhough the project gave a sketch of a methodology, this was to be developed during the project. The training activities were also crucial for the personnel hired specifically for the project as well as for the national participants.

The resource limitations at the national institution level were reflected in the instability of the national teams and counterpart research resources provision during the project implementation. Political tensions in El Salvador and Nicaragua were also forces which produced slowdowns in the work. However, the progress obtained through the work in the different countries plus the previous and compatible experience of counterpart institutions such as CENTA in El Salvador and ICTA in Guatemala enriched the methodology and the whole approach. The acceptance of this approach by the counterpart institutions was clear and some field results were also promising.

In 1979, a second project was approved as a continuation of the SFCS; it was the Small Farm Production Systems Project (SFPS) for implementation during 1979-1983 (8). This second project added responsibilities for research on the technology transfer and extrapolation aspects of the methodology and on animal and mixed crop-animal production systems.

The design of these two projects, and the research work methodology which emerged from their implementation, evolved as a compromise between the basically bio-technical orientation of researchers in different institutions, including CATIE, and the strictly developmental orientation of AID/ROCAP. The evolution of the approach has been reinforced by other research projects financed by IDRC, IFAD, and other similar institutions.

The research and technology development methodology which has emerged from CATIE's outreach work, particularly in crop production, is identified as a variant of the general Farming Systems Research Approach (6).

### The Rationale

The variety of situations in which CATIE had been working showed the need for a general but flexible framework for research and technology development. It should allow for a strategic adjustment to the set of circumstances in which it will be implemented in each particular case. Such circumstances are a combination of: a) quantity and quality of research resources; b) degree of autonomy of the participating institutions from political forces; c) degree of existing coordination and interaction among agricultural institutions, particularly those of research and extension; d) available information about resources, accessibility and other production characteristics of target areas; e) particular characteristics of target area and populations.

Thus, the methodology which has emerged from the outreach work of CATIE contains several phases and details. However, they might not be all necessary or implementable in certain situation. Even the order or timing for implementing different steps may require a particular strategy.

The rationale is based on the recognition that: to attempt an improvement of present cropping systems, or crop production systems, it is first necessary to know those cropping systems as well as the existing conditions to guide the work. Those conditions are the farmer's current resource endowment (quantity and quality), his goals and purposes, as well as his knowledge and management capabilities (what they are doing, how they are doing it and why they are doing it).



### The Strategy

The strategy is an attempt to distribute the basic stages recognized in the Farming System Research approach (FSR), throughout different working phases. These phases are necessary to allow the proper and integrated work of a multidisciplinary team subject to the usual personnel and budget restrictions at national level. Furthermore, it attempts to allow and to promote the complementary action among agricultural institutions.

Simple stated, the phases in the strategy to implement this type of research in specific areas are grouped as follows:

#### Initial Activities

- a) Area selection, which is based on criteria such as national priorities, area potencial for improvement, and possibilities for extrapolating results to and from other areas and farmers (being representative of important ecological and/or socio-economic environments). Many times, however, the target area is predetermined.
- b) Area delimitation and general characterization (technical and socio-economic). This is based on background information complemented by reconnaissance visits to the area or "sondeos" by a team. Sub-information should allow delimitation of relatively homogenous units (in terms of climate, soil, farm resources, etc.), within the study area. These units should be used for surveys, experimental design and

interpolation of results. Each of the selected areas should then be further characterized through informal or formal surveys and/or measurement procedures. Methods used will vary depending on the completeness of existing information and available research resources. The purpose is to identify the relevant crops and cropping systems, the principal constraints on production and productivity and other criteria for evaluating research focus, progress and results. An attempt should be made here to quickly identify "obvious" technological changes which could be introduced and adopted without lengthy testing and evaluations.

#### Yearly Activities

- c) Team analysis of the current technical and socio-economic information about the area, farms, farmers and selected cropping systems. Appraisal of the technical knowledge available to the research team in order to:
- 1) Design and/or review the design of cropping systems modified for improvement. This should pay attention to cropping pattern, crop components and/or different elements of management.
  - 2) Classification of resulting designs according to the team expectation and knowledge of their performance. Resulting groups could:
    - i) need further exploration or support research; ii) need agronomic and/or economic evaluation; iii) need validation<sup>1/</sup> under farmer management; iv) be ready for diffusion.

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<sup>1/</sup> Validation or verification trials correspond to the farmer's testing of a technology with total control by the farmers themselves on their farms.

d) Planning of the field work for the year. All phases should be timed to allow the beginning of the field work in accordance with the agricultural season in the area. Planning should define type, number, experimental design and location of experiments. It should also identify and plan complementary studies for the area characterization and special studies. All activities should be guided by requirements and availability of research resources. The majority of field work should be located on farms and include the farmer's participation even in planning. Work to be implemented could consist of: i) work of an exploratory nature e.g. variety trials; ii) testing of newly designed modification to cropping systems; iii) support research experiments to solve doubts in design; iv) agronomic and/or socio-economic evaluations of previously observed designs; v) validation under direct farmer's management of previously and positively evaluated technology; vi) completion, as needed, of area, farm and cropping system characterization, especially with regard to their dynamic characteristics needing periodic observations; vii) special studies of an agronomic, and/or socio-economic nature. Efforts to report and transfer already validated technologies to appropriate institutions for their diffusion and/or implementations, should also be planned. These include a definition of the timing, procedures and the interaction with other institutions in the area. The planning should be a complete team effort so that most of the work and responsibilities are understood and accepted as appropriate by each member.

- e) Implementation of planned field work. This should include at least a mid year revision of progress to include and rationalize necessary previous and future adjustment to field work in the year.
- f) Team analysis of field work results and updating of the technical and socio-economic information about the area, farms, farmers, and selected cropping systems. With this the team is ready to start the next year's work as in phase c).

In the case of coordination of action among institutions, phases c) through f) are mostly responsibility of the research team. Phases a) and b) could be implemented with a strong participation from the team but with great responsibility from other appropriate institutions. Other institutions dealing with extension and credit should also have leadership in the diffusion and implementation of produced (validated) improved technologies mentioned in phases c) and d).

The need for a multidisciplinary team approach is implicit in the type of research and methodology. The teams should include specialists in agronomy, plant protection, social sciences and extension. These teams are considered multidisciplinary with the need of at least partial interdisciplinary actions during the work. It is intended that no particular discipline or group of disciplines be solely responsible for any major portion of the work. However, it has been clearly seen that there is a need for letting individual scientists have certain latitude for freer action within their discipline which should be justified in terms of the whole team's

objectives. This is reasonable since the whole team's effect is composed of contributions by individual disciplines plus the results from their interactions.

#### DEMONSTRATION AND TRAINING FOR THE USE OF RESEARCH

##### APPROACH PROMOTED BY CATIE

The approach which emerged from the interactive work of CATIE with various national institutes requires multidisciplinary teams, including researchers and extensionists.

The variety of circumstances and resources restrictions faced, at country level, has made it very difficult to form stable multidisciplinary teams with national counterpart personnel, during the outreach experience of CATIE. This has limited the possibilities of evaluating, in a fairly controlled manner, the operationality and costs of the approach in relation to team composition as well as the team needs in terms of management, supervision, and support, particularly in training.

Beginning in 1976 most of the training in this respect, has been attempted through a series of in-country seminars, workshops, short courses and in-service training. At the same time the central elements and principles of the approach have begun to be introduced through specific courses to the M.Sc. degree curriculum in Crop Production at CATIE. Furthermore, the work structure of the Plant Production Department (PPD) was readjusted to provide better support to teams which would be using the approach across

the mandate region. This structure has been strengthened by the resources and activities provided by a project designed for such purpose, which is financed through an agreement between CATIE and IFAD under the name of IFAD-TA 38 CATIE-GRANT.

### The Work Structure

The structure of the PPD should allow the implementation and support of research and technology development activities of multidisciplinary teams working at area level and across the different countries of CATIE's mandate region. Its main components and their purposes are:

"Prototype Teams" for research and technology development in defined geographical areas. These are teams designed and proposed as core "multi-disciplinary teams" composed of three professionals (crop production, crop protection and agricultural economics) available at country level. They utilize the methodology for research and technology development as proposed by the PPD at present, in selected geographical areas across the Central American Isthmus. This allows the PPD to study their requirements in training, resources, general management and support for functioning and operating the approach in a stable manner. They are held responsible for identifying the support which is needed throughout the different stages of the technology development work and for searching and channeling it to their work area from appropriate sources and institutions including CATIE. This experience also allows demonstration of the feasibility and effectiveness

of the methodology to national institutions, with which those teams interact, as well as the training of personnel in its use. The PPD has installed "Prototype Teams" in Nicaragua, Costa Rica and Panama. Each team has been provided with a vehicle, and two motorcycles plus some minor equipment for field work and money for operation.

"Support Team". This component includes the personnel and operational resources available in the PPD to provide specialized support to teams engaged in technology development across different areas of the mandate region. This team's activities include "supportive research", to address research problems which require special methods, more control or the time which is not possible to provide in the adaptative type on-farm research. The subjects for "support research" should be identified as a priority for the work of any outreach team in at least one particular situation across the region; this will ensure the immediate use of the results there. It is also expected, however, that those results will have a wider application in terms of area or as a disciplinary contribution. The "Support Team" also provides specialized scientific support when requested by teams located across the region. Presently in the PPD the principal responsibility of the Support Team is to interact with the Prototype Teams, to support them and also to study and develop appropriate procedures for providing such support to similar teams. The team includes specialists in cropping systems, soil management, crop physiology, weed management, genotype evaluation, agricultural economics, agricultural extension and data management.

"Training Office". This office is responsible for synchronizing the training capability and plans of the PPD as a support unit, with the corresponding national needs and priorities, particularly those of teams working in defined-area technology development. In specific it should help to study and develop appropriate strategies for training personnel in the use of research and technology development approach promoted. This should be based on the experience gained through the Prototype Teams.

"Outreach Coordination". This key element has as purpose to constitute a linkage and communication mechanism between the PPD and national institutions, particularly national teams working in defined-area technology development. This is done through an in-country resident professional when available. Furthermore, the Outreach Coordinator motivates the establishment of linkages among national institutions and their teams working in technology development throughout CATIE's mandate region. This mechanism is expected to improve synchronization of the PPD's capability and plans to provide scientific support with national needs and priorities, in the fields of agricultural research, training and technical cooperation. Within the PPD, the Outreach Coordinator also channels the Departmental support to the Prototype Teams.

"Operational Support". This component includes the personnel and other resources which constitute the administrative and logistical support capability of the PPD.



Progress in the Operation of the Prototype Teams

Two Prototype Teams were installed and began working as part of the CATIE/IFAD Project in January of 1982, in Nicaragua and Costa Rica. All professionals in each team were hired by the PPD. A third team was installed in January of 1983 in Panama; one of its professionals works for and is financed by IDIAP, the national research institute. This responds to the objectives of proposing such teams as operational units of national institutions, and to promote their use of the on-farm technology development methodology. All three teams have been trained and supported by professional personnel from the PPD. The training and support provided have been adjusted both in content and form in response to the needs evident during management and normal operation of the teams. Progress was evident during the training of the Panamanian team which was based on the experience of training two Prototype Teams in 1982 (4). The installation of additional and similar teams under national financing is being discussed in Panama, El Salvador, Costa Rica and Honduras.

The purpose of installing and monitoring the activities of "Prototype Teams", to study their management, training and support needs, is being accomplished. The key elements are appropriate training, and supervision by a professional experienced in the use of the methodology during their initial work stages. Some field assistance and hand labor to increase coverage have also appeared as necessary. The goals of demonstrating the feasibility of the methodology and training personnel for its use are also

being accomplished. It is clear, however, that additional time will be needed since these activities require that the teams be already installed and producing results.

At present, all three teams characterized their work areas and produced documents containing this information, for distribution among national professionals. Based on the characterization of their areas and the technical knowledge available, all teams have designed a first approach for improving the technology of selected cropping systems. These ideas are being tested for the first time during 1983 in Panama. The teams in Nicaragua and Costa Rica are incorporating the experience and results of their first on-farm testing cycle (during 1982) into the second round of adjustments, testing and evaluation during 1983. Selected cropping systems include different combinations of maize, sorghum and beans in Nicaragua; maize, cassava and beans in Costa Rica; and rice, maize, tomato and other vegetable crops in Panama.

All three teams have established and developed good working relations with national research, extension and training institutions in each country. These institutions include IDIAP and MIDA in Panama; MAG, IDA and ITCR in Costa Rica and MIDA-INRA in Nicaragua. As part of this interaction, all teams keep their counterpart institutions informed of plans, progress and results as well as of the teams' support needs. In the same manner, they provide the support which is required from then by national institutions, either directly or with help from the PPD. This has included the supervi-

sion and development of several B.S. degree theses with students from Costa Rican professional schools, as part of their planned field work.

The installation, training and operation of these "Prototype Teams" has appeared as a very promising form of demonstrating the approach, promote its use and train personnel for such use. The lessons obtained go beyond the specific methodological and operational issues of the approach to put questions in relation to the profile and training of available professionals for agricultural research or extension at country level.

#### LESSONS FOR FUTURE TRAINING IN AGRICULTURE

Both, the particular characteristics of the research approach discussed and the professional profile and training of available personnel have determined the content and form of the training provided by CATIE for using the approach. It was not originally expected that the training required would contain any element strange to the normal professional training in agriculture at the University level. However, some basic weakness has commonly appeared in the knowledge and general capability of available professionals. A short review might help to identify areas for improvement.

Possibly the central weakness noted is in the ability of many professionals in agriculture for practical application of the knowledge obtained, including some basic principles of production. This seems to be consequence of the emphasis given in their training to the analitical principles and procedures in opposition to those of synthesis. The same is reflected in an

almost generalized lack of courses which help to integrate, in the mind of the young professionals, the knowledge provided through many specialized courses. Even the basic course in ecology is included in the curriculum of few agricultural schools only. Furthermore, some courses which are of general application such as basic agricultural economics and statistics are usually treated as courses for specialization. This weakness needs particular consideration while training for different phases of the approach discussed. Two critical moments are: a) when the information obtained in the characterization should be considered in an integral manner to diagnose the main technical problems and their order of priority for attention and b) when the results from characterization are confronted with the technical knowledge available to design appropriate technical solutions to the priority problems.

Other manifestation of the same weakness noted is the lack of knowledge by many professionals about the most generalized forms or systems of agricultural production throughout their countries. Likewise, young professionals have almost no knowledge about the agricultural institutions in which most of them will work later. This includes the elemental knowledge about mandates in terms of subject matter and methods of working, including interactions, as well as availability of resources, structure and general work conditions in those institutions.

The different forms of training for the use of the approach discussed has been somewhat complicated because of the need to reinforce some of those "weak points".

As a whole, the training for the use of the approach requires an effort for integration of knowledge and procedures of different nature. Thus the Plant Production Department is attempting to use the sequence in the approach to design a series of courses which would serve as backbone and integrator of the courses in the curriculum for the M.Sc. in crops production. Furthermore, since 1983 an intensive three to four months course in "Cropping Systems Research and Technology Development" is being offered at Turrialba, beginning in August every year. This non-degree course is designed for national professionals who work in agricultural research and agricultural extension. In the same manner similar courses could be designed and included as part of the curriculum of the agricultural schools at university level. They would help to better integrate in the mind of the students the knowledge provided through specialized courses allowing a better use of such knowledge. They would also help to identify gaps in the training which is being provided, giving time to complement it as necessary. Those efforts at the undergraduate university level might pay later in terms of diminished needs for postgraduate elemental training and better utilization of postgraduate specialized training. The possibility of obtaining professionals with a profile which is more appropriate to the work conditions and needs of present agricultural institutions should also be kept in mind.

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