CATIE
CENTRO AGRONOMICO TROPICAL DE INVESTIGACION Y ENSEÑANZA
Crop Production Department

DEVELOPING TECHNOLOGY FOR SMALL FARMS; A CASE STUDY IN CENTRAL AMERICA

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Paper prepared for the symposium: "Farming Systems in the Field", Kansas State University, Manhattan, Kansas, USA, November 21-23, 1982.

Turrialba, Costa Rica

October 1982

ACRONYMS

AID	Agency for International Development, United States
CATIE	Centro Agronómico Tropical de Investigación y Enseñanza (Tropical Agricultural Research and Training Center)
CENTA	Centro Nacional de Tecnología Agrícola (National Center for Agricultural Technology), El Salvador
CPD	Crop Production Department
DDA	Swiss Program of Cooperation for Development
DGTA	Dirección General de Técnicas Agropecuarias (General Direction of Farming Technics), Nicaragua
EEC	European Economic Community
FSR	Farming Systems Research
GTZ	Gesellschaft fur Technische Zusammenarbeit (Agency for Technical Cooperation), Germany
IBM	International Business Machines
ICTA	Instituto de Ciencia y Tecnología Agropecuarias (Institute for Agricultural Sciences and Technology), Guatemala
IDB	International Development Bank
IDIAP	Instituto de Investigaciones Agropecuarias de Panamá (Agricultural Research Institute of Panama), Panama
IDRC	International Development Research Centre, Canada
IFAD	International Fund for Agricultural Development
IICA	Instituto Interamericano de Cooperación Agrícola (Interamerican Institute for Agricultural Cooperation)
IRRI	International Rice Research Institute
LHT	Low Humid Tropic
MAG	Ministerio de Agricultura y Ganadería (Ministry of Agriculture and Livestock), Costa Rica
PROCAMPO	Programas Campesinos (Peasant Programas), Nicaragua

OAS	Organization of American States
ODA	Overseas Development Administration, United Kingdom
PNIA	Programa Nacional de Investigación Agropecuaria (National Program for Agricultural Research), Honduras
ROCAP	Regional Office for Central American Programs
SAT	Semi Arid Tropic
SFCS	Small Farmer Cropping Systems
SFPS	Small Farm Production Systems
UK	United Kingdom
UNU	United Nations University

THE INSTITUTION

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 with focus on the Central American and Caribbean regions.

CATIE was founded in 1973 as an association between IICA, the specialized agricultural body within the OAS, and the Government of Costa Rica. Guatemala, Honduras, Nicaragua and Panama have also become partners in the association while the memberships of El Salvador and Dominican Republic are in process.

The priority for CATIE's orientation and focus on the "Small Farm Sector" of the region was identified by the member countries in 1973 (2).

CATIE operates with a staff of 80 professionals in different fields of agriculture (half of them expatriate), and a budget of ten millions 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, Kellog Foundation and the Government of Holland. IICA and the member governments provide the core budget (8).

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

CATIE develops most of its activities out of Turrialba at country level and in strict interaction with the different national institutes.

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.

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INTRODUCTION

This case study begun in 1973 in Turrialba, within the Department of Crop Production of CATIE. However, it has evolved as a regional and co-operative effort of different national institutes and CATIE, at field level and across all the countries of the Central American Isthmus[2/]. It is operative in at least two specific geographical areas, with concentration of small farmers, in each of the following countries: Guatemala, Honduras, El Salvador, Nicaragua, Costa Rica and Panama.

Different aspects and comments related to the identification, design, implementation and evaluation of two research projects which conform the case study, will be presented here.

Somme comments will also be advanced in relation to remaining issues and implication for the future of the FSR approach used, as seen from the perspective of the participants in this case study.

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

1/ The author is grateful to R. Hawkins and C. Burgos for their contribution and comments for this paper.

2/ The results and observations presented in this paper are the joint product of CATIE and the following institutions: CENTA of El Salvador, DGTA of Nicaragua, ICTA of Guatemala, IDIAP of Panama, MAG of Costa Rica and PNIA of Honduras.

IDENTIFICATION

In 1973 the personnel of the "Tropical Soils and Crops Department", of the recently founded CATIE, decided to focus their research activities on the study and technical improvement of the crop production systems used by the small farmers of the Central American region. This was in agreement with the priority given to the Small Farmers Sector, by the different governments of the region, during a consultation and diagnostic made across the Isthmus (4).

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 peoples in the region. Their resources, low in quality, amounted to only one fourth of the total farm land and less than one fifth of total farm input expenditures, while their per capita income was under US$100 per year. They provided, however, two thirds of the total active-rural labor force and over two thirds of the food crops produced value (excluding rice) for the region. Their participation in rice, perennial crops and livestock, which the region exports, amounted to 36, 39 and 21% of their total production value respectively. Given the forecast for the next twenty years for 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.

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 research station, in order to learn the management and test the productive potential of various crop systems. These were different cropping-patterns formed with corn, beans, cassava, rice and sweet potatoe, chosen to simulate some of those found on small farms.

Soon they acknowledged the need to approach the farmers directly to find what they were really doing, how and why. They visited farmers and some experimental plots were installed on selected farms or on experimental fields of Agricultural 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 had 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).

Following the conference, AID and CATIE formalized the CATIE/ROCAP Small Farmer Cropping Systems Project (SFCS), approved in 1975 with 1.6 million dollars in grant funds to CATIE and for implementation of the project 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 an strict interaction with personnel from the national research institutes.

In 1979 the CATIE/ROCAP Small Farm Production System Project (SFPS) was approved as a continuation and expansion of the SFCS, with a budget of 7.4 millions dollars and for implementation during 1979-1983 (12). 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.

DESIGN AND IMPLEMENTATION

The design and implementation of the central projects in this case study evolved as a compromise between the basically bio-technical orientation of researchers and the strictly developmental orientation of AID/ROCAP.

The Initial Project

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 personnel.

To accomplish the objectives 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.

Furthermore, the in-country research was to include: 1) design and implementation of surveys of small farmer characteristics and their cropping systems, 2) use of this material to compile profiles of the target areas, farmers and their farming practices, 3) design and implementation of on-farm research to increase small farmer's yield through the improvement of their cropping system performance, 4) development of ten area-specific technical recommendations by the end of the project.

Even though 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 personnel hired for the project included one Resident Agronomist to coordinate the activities in each participating country and five specialists (Biometrics, Entomology, Soil Management, Horticulture and Agricultural Economics) to act as a back up team from Turrialba.

Agreements were signed almost immediately (1975) with the governments of Costa Rica, Nicaragua and Honduras. The work in El Salvador and Guatemala, however, did not begin until 1977 and 1978 respectively even though the agreements were signed in 1976 (10).

The resource limitations at the national institution level were reflected in the unstability 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 clearly 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.

General comparison indexes between some on-farm research results and the farmers check cropping systems, obtained in different areas, are shown as examples in Tables 1, 2, 3 and 4 (11). These results were obtained under the direct observance, council and participation of farmers and farm labor. The members of farms on which different experiments were replicated varied from two to ten depending on the area. In most cases the performance indexes for the check cropping system include data from more farmers than those directly involved in the experiments.

The SFCS project advancement stopped just short of verification studies. One attempt was made on 40 small farms of Estelí, Nicaragua, where one of the technical recommendation developed in Samulalí was "verified" even during the revolution in 1978-1979. Furthermore, in 1980 the new government took interest in disseminating that technical option in the Matagalpa and Estelí

Table 1. Location and cropping pattern characteristics of farm level tested modification to cropping systems practiced by small farmers of different areas in Central America (CATIE 1978-1979).

Geographic Area		Cropping Pattern		
Country - Location	Gen. Charact.	Studied	Check	New variety?
COSTA RICA				
Guácimo-Pococí	H	cassava + corn + beans	cassava + corn	No Yes, yes
Guácimo-Pococí	H	corn / corn	same	yes, yes
Pérez Zeledón	H→S	corn / beans	same	yes, no
Pérez Zeledón	H→S	corn + beans / corn + beans	corn + beans / beans	yes, yes no, no
HONDURAS				
Yojoa	S→H	corn + pipián / corn + pipián **	corn + squash / corn + squash	yes, yes N.C., N.C.*
Yojoa	S→H	corn + cowpea / corn	corn / corn	yes, yes N.C.
Yojoa	S→H	corn + rice / cowpea	rice / beans	yes, N.C. yes
NICARAGUA				
Samulalí	H→S	corn / beans	same	yes yes
Samulalí	H→S	sorghum + beans / sorghum + beans	beans / beans	N.C., N.C. yes, yes
SALVADOR				
Chalatenango	S	corn / sorghum	same	yes no

H = humid; S = dry with a short rainy period; S→H = dry period tends to to be longer than the humid period; H→S = humid period tends to be longer than the dry period.

* N.C. = New crop as an addition or change within the cropping pattern.

** Pipián is a type of squash (Cucurbita spp.) consumed as an inmature fruit.

Table 2. Changes in some technical economic indexes as a result of farm level evaluated modifications to cropping systems practiced by small farmers in different areas of Central America (CATIE 1978-1979).

Geographic area "cropping pattern"	Labor Man day/ha %Δ	Inputs CA$/ha (b) %Δ	Total cost (d) CA$/ha %Δ	Total cost (d) CA$/ha	Net Income CA$/ha %Δ	Family Income CA$/ha %Δ	Family Income CA$/ha
COSTA RICA							
Guácimo-Pococí							
Cassava + (Corn//Beans) (e)	72.2	172.8	100.1	1305.7	181.9	140.6	2494
Corn - Corn	30.7	94.7	53.2	904.1	19.1	25.3	898
Pérez Zeledón							
Corn-Beans	15.0	269.0	51.0	673.3	403.0	130.0	1255
(Corn+Beans) - (Corn+Beans)	57.7	553.8	115.5	1043.9	-147.8 (-43.5) (c)	-40.9 (+9.35)	461
HONDURAS							
Yojoa							
(Corn+Pipián) + (Corn+Pipián) (a)	-1.0	83.0	23.0	369	152.0	62.0	605
(Corn#Cowpea) - Corn	17.0	42.9	26.0	351	19.3	19.0	672
(Corn+Rice) - Cowpea	8.4	27.0	15.0	395.8	-26.0 (+273.0)	-2.0 (+96.0)	328
NICARAGUA							
Samulalí							
(Corn#Beans)	28.1	22.2	24.1	576.4	62.9	38.5	668
Sorghum + (Beans//Beans)	22.9	-1.5	10.1	586	5002.0	126.0	713
EL SALVADOR							
Chalatenango							
Corn#Sorghum	16.4	105.3	37.2	599.4	62.7	36.5	805

(a) Pipian is a type of squash (Cucurbita spp.) consumed as an immature fruit.

(b) 1CA$ (Peso Centroamericano) = 1US$ (United States Dollar); %Δ = percentage of increment in relation to the farmer's check cropping system performance.

(c) All comparison are based on the worst on-farm experimental results or 70% of experimental averages. Figures in parentheses show experimental averages.

(d) Total cost includes all factors including land, management and use of capital.

(e) + is in the ground with; - is followed by; # in relay with; // followed shortly after by.

Table 3. Technical economic efficiency indexes for some farm level evaluated modifications to cropping systems practiced by small farmers in different areas of Central America (CATIE 1978-1979).

Geographic area "cropping pattern"	Net Return Over Additional Investment CA$/1US$ (b)	Return to					
		Cash Input Costs		Labor		Land	
		CA$/1US$	%Δ (c)	CA$/man day	%Δ	CA$/ha	%Δ
COSTA RICA							
Guácimo-Pococí							
Cassava + (Corn//Beans) (a)	1.7	2.95	9.7	20.6	49.3	1695	112
Corn - Corn	.2	.80	-38.9	10.0	-4.6	448	17
Pérez Zeledón							
Corn - Beans	2.8	3.60	36.0	11.7	117.0	854	307
(Corn+Beans) + (Corn+Beans)	-.3	-.17	-121.0	3.0	-66.6	-121	-130
						(253)	(-38)
HONDURAS							
Yojoa							
(Corn+Pipian) + (Corn+Pipian) (a)	3.2	2.7	38.0	3.5	155.0	406	127
(Corn#Cowpea) - Corn	1.5	4.9	-17.0	6.8	2.0	702	18
(Corn+Rice) = Cowpea	-.5	.6	-4.0	.7	-29.0	115.2	-18
	(+5.9) (d)		(+193)	(+3.6)	(+246)	(+444)	(+215)
NICARAGUA							
Samulalí							
(Corn#Beans)	1.0	2.6	17.0	4.1	4.0	310.0	54
Sorghum + (Beans//Beans)	6.3	.7	450.0	2.7	400.0	378.0	908
EL SALVADOR							
Chalatenango							
Corn # Sorghum	1.0	2.0	-20.7	7.4	19.5	474.0	51

(a) Pipian is a type of squash (Cucurbita spp.) as an immature fruit.

(b) 1CA$ (Peso Centroamericano) = 1US$ (United States dollar).

(c) %Δ percentage of increment in relation to the farmer's check cropping system performance.

(d) All comparison are based on worst on farms experimental results or 70% of experimental averages. Figures in parentheses show experimental averages.

(e) + is in the ground with; - is followed by; # in relay with; // followed shortly after by.

Table 4. Effect on per ha production and productivity of several farm level evaluated modifications to cropping systems practiced by small farmers of different areas of Central America (CATIE 1978-1979).

Geographic Area		Cropping Pattern*			
Country-location	Gen. Charact.	Modified		Farmers check	
COSTA RICA					
Guácimo-Pococí	H	Casv. 30.5 - 32 T Corn 1.4-1.6 T	B.9-1.1 T	Casv. 10 - 12 T Corn 1-1.8 T	
Guácimo-Pococí	H	Corn 3-4.3 T	Corn 3.2-4.5 T	Corn 1.8-2.6 T	Corn 1.0-1.8 T
Pérez Zeledón	H↔S	Corn 4.7-6.6 T	B.8-1.2 T	Corn 1.4-2.2 T	B.4-.6 T
Pérez Zeledón	H↔	Corn 2.2-3.1 T B.1-.2 T	Corn 1.3-1.9 T B.1-.2 T	Corn .9-2.4 T B 0-.15 T	B.3-.5 T
HONDURAS					
Yojoa	S↔H	Corn 2.2.5 T P. 3.5-5TU	Corn 1-1.5 T P. 3.1-4.4TU	Corn . 8-1 T SQ. .9-1.1TU	Corn .3-.8 T SQ. .8-1 TU
Yojoa	S↔H	Corn 2.5 3 T CP.5-.8 T	Corn 1.5-2 T	Corn 1.0-2.5 T	Corn. 4-1.8 T
Yojoa	S↔H	Corn 1.0-1.5 T R 1.0-1.5 T	CP. .4-.8T	R.5-1 T	B 0.-.5 T
NICARAGUA					
Samulalí	H↔S	Corn 4-5.2 T B.8-1 T		Corn 2-3 T B.5-.6 T	
Samulalí	H↔S	S. 1.1-1.6 T B.9-1.3 T	SR .6-.8 T B.6-.8T	B.8-1 T	B.6-.1 T
EL SALVADOR					
Chalatenango	S	Corn 3-3.5 T S 2.5-3 T		Corn 1.8-2 T S 1.1-1.5 T	

* Symbols: Casv. = Cassava; corn = corn; B = beans; P = pipián; SQ = squash; R = rice; CP = cowpea; SR = sorghum ratoon; T = metric ton; TU = thousand units.

H = humid; S = dry with a short rainy period; S → H = dry period tends to be longer than the humid period; H → S = humid period tends to be longer than the dry period.

areas through PROCAMPO the new extension institution. However, priorities and plans were later changed.

Based on different progres evaluations of the SFCS project, a new four year project was designed to follow up and expand on the initial one.

The Second Project

The new regional project was the Small Farms Production Systems (SFPS) project, to be implemented through the same type of interactive work with national institutions (12).

Its design included:

a) Research for the development of improved technical options for small farmers of target areas and for their:

   1) Crop production systems (ten).

   2) Animal production systems, particularly those which include "small species" (six).

   3) Mixed crops-animal production systems (three).

b) Research on methodologies for the "extrapolation" of area-specific research results to analogous situations.

c) Research on technology-transference.

d) Training of national personnel in methodology and other aspects related to the advancement of the project.

Thus the SFPS project would allow for a better definition of the research methodology as part of the process of technology development within a given area, and for addressing the two related key issues of

site-specificity and the research-extension interphase. Furthermore, it would allow to expand the project scope from cropping systems to include animal production systems and mixed crop-animal production systems within the small farm, as possible steps toward a "whole farm approach". In what follows of this presentation, the focus will continue to be on the crops component of the project.

Additional resources were provided to include activities in Panama and for reinforcing the team with appropriate personnel for the technology transfer activities.

The implementation of the SFPS project has not been without problems. Some are similar to those of the previous SFCS project. Others include slowdowns of the research on: "extrapolation" because of personnel changes within the project team, and "technology transfer" because its allocated budget was delayed up to October of 1981. Today, however, the project is being implemented in all its components and in 16 different target areas across the six countries and sampling the main ecological situations of the Isthmus (7).

The interaction among the research personnel from CATIE and the national research institute with the extension personnel, at field level within the different target areas, is being motivated and becoming stronger. The interaction among crop production and animal production scientists within and outside CATIE is also evolving[1/].

1/ A Symposium on Mixed Crop-Animal Production Systems was held in CATIE with the participation of Winrock Int. and CARDI in August 1982 (5).

Several technical recommendations in crop production as well as in animal production have been developed and evaluated through on-farm research. Some of those in crop production are being "verified" (or "validated") under the strict management of at least 30 farmers each. These include simple changes in the following cropping systems and areas: potato-(maize+ beans) in La Esperanza, Honduras; maize-beans and maize/sorghum in Comayagua, Honduras; maize/sorghum in Tejutla and San Miguel in El Salvador; maize-beans in Matagalpa, Nicaragua; maize-maize and maize-cassava[1/] in Guápiles, Costa Rica (6). In some cases the first harvest has already taken place and results are very promising. As expected, the technology has shown to be feasible in terms of the availability of resources and management capability of farmers. Measured yield increases in maize, under those situations, has been at least 60% with less than proportional increases in cost; thus improving the income possibilities for farmers under their present circumstances.

Several mixed crop production systems of importance on small farms have been identified and joint research efforts, of animal production and crop production scientists, have begun for improving their performance in areas of El Salvador, Honduras, Nicaragua and Costa Rica. These production systems include the widely spread maize/sorghum cropping pattern associated with duel purpose cattle production in the SAT[2/] and the use of plantain and other crops residues as feed for pigs in the LHT[3/] of the region.

1/ - is followed by; / in relay with; + in association with.

2/ SAT = Semi Arid Tropic.

3/ LHT = Low Humid Tropic.

Some technical changes developed to improve the maize/sorghum cropping system in San Miguel of El Salvador, are being tested during 1982 on over 70 small farms of 35 different and seemingly analogous sites of the SAT in El Salvador, Guatemala, Honduras and Nicaragua. This effort is part of the research on "extrapolation" which began by considering the location of the maize/sorghum cropping system in the region and the climatic and soil information of these locations to assess on the possibilities for extrapolating a given technology.

The "verification" trials, mentioned above form part of the research on "technology transfer".

During August of 1982 the project implementation, only in its crops component, included the direct participation of a) 20 professionals from CATIE, b) at least 75 professionals from national institutions, c) more than 40 persons, from CATIE and the participant institutions, involved in administrative and field back up and d) 60 field workers. During the same time, some type of activity related to the project was carried on over 400 small farms, with different degrees of participation from the farmers themselves and across the 6 countries of the Isthmus (7). Field days and meetings of different kind help to present the project activities and results to more farmers and technicians in the different target areas.

EVALUATION

Different evaluations have been scheduled during this case study. They have been implemented through teams of knowledgeable people in FSR,

who visit Turrialba and the different sites and participating institutions across the region, to survey the present state of implementation and repercussion of the project in comparison to what it was expected. Usually these teams are formed and hired directly by ROCAP/AID in consultation with CATIE. Other cases of evaluation have been in the form of consultant services hired directly from selected scientists by CATIE.

Evaluations have been favorable in terms of opinion and direct contributions to the project development. Many personalities involved in these evaluations are well known to the FSR practitioners. One of the best documented evaluations is the AID Project Impact Evaluation Report No. 14, made in December of 1980 and reported as "Central America: Small-Farmer Cropping Systems" (10).

A final type of evaluation is that made by the personnel directly involved in the project. The following is an attempt to review the methodology, which emerged from the project, to evaluate its state of evolution and possible repercussions, as seen by the participants in this case study.

THE METHODOLOGY AND ITS BACKGROUND

The variety of situations in which the project has been implemented shows that the FSR approach is useful as a general framework. Within that, however, a strategic adjustment to the set of circumstances in which the approach is implemented should occur. 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 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 emerged from this case study contains several phases and details. However, they might not be all necessary or implementable in certain situations. Even the order or timing for implementing different steps may require a particular strategy.

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).

Existing conditions at the small farm level, which determine most of the cropping system characteristics, are consequences of the ecological as well as socio-economic environment in which small farmers work.

The local ecological environment determines most of the physical and biotic characteristics of the resources handled by farmers. These characteristics force certain technological adjustments in the cropping systems as well as adjustments and priority changes in farmers' goals. For example, in areas of erratic rainfall (i.e. the North of El Salvador), small farmers have developed cropping systems based mainly on corn and sorghum, mostly as association or relay crops. In case of insufficient rain for corn, (the preferred crop), they will at least harvest sorghum, diminishing the

implied risks for their subsistence. In areas where there are possibilities of excessive rain, farmers prefer associations based on rice and corn. Even the localization and arrangement of those crops within the farm are accounted for by the amount of water available in the soil.

The influence of society is shown mainly in the poor geographic location and income-bracket of small farmers. They have been relegated there by the general type of agricultural development and its present structure, based mainly on large scale, capital intensive, export-type production. However, society may also provide incentives and supporting guidance to small farmers. These may come as improvement to their products market (marketing institutions), reinforcement of their resource endowment (credit, subsidy, input and machine service institutions) and reinforcement of their knowledge (research and extension type institutions).

STRATEGY

The strategy to be described is an attempt to distribute the basic FSR stages throughout different working phases. These phases are necessary to allow the proper and integrated work of a multidisciplinary research 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.

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

Initial Activities

a) Area selection, which is based on criteria such as national priorities, area potential 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 to the institution.

b) Area delimitation and general characterization (technical and socio-economic). This is based first on background information complemented by reconnaissance visits to the area or "sondeos" by a team. Such 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 units should now 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[1/] under farmer management; iv) be ready for diffusion.

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

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

exploratory nature e.g. variety trials; ii) testing of newly designed modifications 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 farmers' 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 implementation, 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 with other institutions, phases c) through f) are mostly the 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 different teams formed during this case study have included specialists in agronomy, plant protection, social sciences and data processing. These teams are considered multidisciplinary with the need for 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 and the results of their interactions.

The work requires a change in attitude from each scientist who has been trained as an specialist.

IMPLICATIONS OF THE METHODOLOGY IN ITS PRESENT STATE

Evolving from the original idea of focusing research, possibly in a more traditional and controlled manner, on the cropping systems used by the small farmers, the final methodology in the case study considers and explicitly positions the research within:

a) The whole process of technology development for a given area and in contact with the beneficiary farmers on their own farms.

b) The whole set of circumstances of the farms in which the technology should operate and produce tangible benefits to farmers and society.

However, it is still centered around the researcher and extensionist responsibilities within the technology development process. The participation and influence of other agricultural support institutions is usually considered as exogenous.

Within research itself, it is centered around an "adaptive" type of research even though its ties with and motivation for a "support" type of research are constantly evolving.

At the farm level it still focuses the attention on particular components of the whole farm (particular cropping systems, animal production systems or mixed crop-animal production systems). Even though it requires a careful consideration of the interaction of the target production system with the remaining of the farm, it is short of being a "whole farm approach" or "FSR on the large" as is conceptually proposed by many.

However, even in its present stage of evolution, the methodology has a serie of repercussions and requirements. The participant researcher sees his traditional scope of work increased in two dimensions: 1) as part of the whole technology development process, 2) as part of a production system within a farm and all its circumstances. Even though he realizes that this fact puts his work in much better perspective, he needs guidance to understand that it is not required nor convenient that the researcher become

responsible of everything within this amplied scope. He should be motivated to accept and search for the support and complementary work of other participant disciplines and institutions to make the whole approach more efficient. The principal motivation should be for the use of existing technological knowledge and documented research results, whenever possible and appropriate. The interaction with extension personnel is useful during the area selection and diagnostic stage as well as in selecting collaborating farmers and in interacting with them during the on-farm evaluation or validation trials, and the extension phase. Interaction with technicians from other institutions should also be motivated when appropriate.

Furthermore, when the participation of extensionists or technicians from other institutions are not made explicit or they are not advised when some activities related to their field and work area are necessary, some misunderstanding might arise. The most common are the apparent duplication of activities or interferences which are not well thought out from the institutional organization point of view, and are detrimental for motivating any desired collaboration. To avoid this a continous effort of communication with other institutions working in the area might be needed.

The previous observations tend to suggest that efforts similar to the case study should be proposed as temporary and geared to put in proper perspective, motivate and organize the needed interactive and cooperative work among the different institutions with responsibilities in technology development. This promises to benefit their individual as well as their joint contribution to development. The effect of this might also motivate appropriate

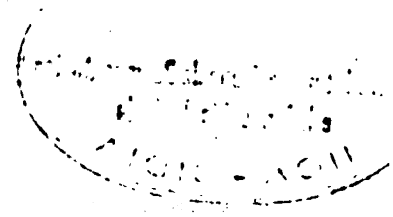
legislation and resource allocation to make this permanent.

Many observers of the approach in its present state tend to point out its apparent greater requirements, in resource quantity as well as quality and organization, than is presently available. However, these requirements also exist under the more traditional approaches and it is not clear yet that those observations are true. Possibly the foremost requirement is a reorientation and reorganization of existing resources in the different institutions to allow their effective interaction. It does not even require changes in their present broad objectives and responsibilities for cooperative work; but it does require to accept these as appropriate and desirable for their own effective work.

Clearly, however, the approach requires motivation and special training for all new participating personnel. To diminish this need in the future, such motivation, orientation and training should be incorporated as part of the normal professional preparation before graduation.

Crucial elements in training include the background and operation of the methodology as well as team organization and leadership. A complementary element found at fault, in most situations, relates to the capability to identify and properly design projects which could be proposed for financing by the government or other available sources.

The regional character of the case study has shown that the whole approach can be greatly benefited by a networking of the teams operating in different areas and across countries. This provides for cross feeding of information, motivation and more attractive possibilities for training in benefit of overall efficiency.



REPERCUSSIONS OF THE CASE STUDY

The repercussions of this case study have been analyzed at the CATIE, national institution and the farmer levels.

The repercussions in CATIE have been especially important within the Crop Production Department. The CPD centers its work on research and training for the development of production technology in important cropping systems on small farms of the region. This is done by promoting, stimulating, and participating in the formation, training, work and support of national multidisciplinary technology development teams. It is achieved by the interaction of two structural elements, 1) outreach for direct support to research institutions and 2) activities at CATIE, such as supportive research, methodology development and training, in support of the outreach. The first element acts and interacts with national institutions across the countries of the region. An Outreach Coordinator has the basic responsibility of providing a two-way communication between national research programs and the cropping systems research team and support components of the CPD. The second element provides a linkage of research across countries and ecological situations within the mandate region. This is achieved by lending scientific support to country teams in terms of genetic material, research methods, specific component technology, documentation, laboratory, data processing and biometrics services. In addition a specific support research team was formed to back up national teams working mainly within the SAT and LHT of the Isthmus. Training personnel and activities also support the network of research sites by providing task-specific training

as well as in the methodology for interdisciplinary research with farmers' participation. Resources for the reorganization of the CPD have been provided since 1978 by different agreements and projects designed to allow the complementarity and organization of the different activities of the CPD, under the approach developed during the case study. Financing has been provided by AID, EEC, GTZ, IDRC and IFAD.

At the country level, every research institution is aware of the approach promoted by CATIE and is utilizing it to different degrees. In every country at least one research institution is participating as part of the regional effort presented in this case study. In many cases moreover, there are similar efforts which have begun in other areas of the country and usually in interaction with other international research support or financing institutions reinforcing the use of the approach in the region. The requirement, for training in the use of the approach and in the identification and design of projects using it, have also increased at country level. It is anticipated that this support will be needed for several years.

At farmer level, and even though the case study has not entered completely into the extension phase, there are some direct repercussions. In all the target areas many farmers have provided direct cooperation to the technicians and they have also received some technical feedback, mostly in an informal manner and in aspects beyond the work specific to the case. Many of them have received inputs, for plots as large as 1000 m^2 and 0.7 ha[1/] during verification trials. In some of the target areas, such as

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1/ 0.7 ha = 1 manzana, land measurement unit used in Central America.

Matagalpa in Nicaragua, some technical elements have been picked up by several farmers even from evaluation plots without any transference effort. In other areas farmers seem to be increasing their confidence in technical personnel; at least in accepting to interact with them.

The direct interaction between researchers and extensionists at the area level is benefiting both groups and the farmers. However, there is much to do yet, to reinforce the research-extension transition and extension phase in the approach within the case study. In the same way there are still needs for developing specific and simpler procedures, particularly for the "grey areas" which coincide with the transitions among different phases of the approach and with the interaction among institutions. All these will be crucial in relation to the organization among institutions and political commitment to a continuous and efficient technological development effort, given their resource endowment.

So far the methodological evolution and state of development of the research approach described is very promising. However, the awareness and willingness of the technicians involved in this type of work at field level, might become as important as the approach itself for closing the time lag between an initial investment in research for a given area, and its measurable impact at farm level. This implies that even though temporary, efforts such as this case study promise permanent benefit to the agricultural research institutes and farmers of the region.

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