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FARMING SYSTEMS RESEARCH SYMPOSIUM

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SYMPOSIUM ON FARMING SYSTEMS RESEARCH: INTRODUCTION AND OBJECTIVES

Quentin M. West*

INTRODUCTION AND OBJECTIVES

U.S. overseas technical assistance programs are grounded in methods and expertise developed and applied here at home. This is an assumption underlying all such work. It was explicit in the Point-Four days of the 1940's and 1950's and, though not emphasized, remains as part of our philisophy today.

The notion is particularly strong in technical assistance in agriculture. Variants of the U.S. model for agricultural research and extension have been applied in dozens of developing countries during the past 30 years. Though this application has contributed to significant increases in agricultural productivity and rural incomes in a number of countries, the benefits have often been unequally distributed toward larger farmers having access to required services and inputs. For small farms in most countries the application has failed. Research results have become laboratory shelf items, never reaching the farmer or bearing little relevance to the constraints under which he operates.

The applications have failed because they have been largely based on the notion that technological progress in agriculture is a monotonic sequence from the laboratory to the test plot to the extension agent to the farmer. It is a highly over-simplified version of our research and extension system. It does not take into account the economic, social, and institutional environment in which U.S. farmers operate.

The farming systems approach to agricultural research and extension has arisen out of the realization that too many of the necessary elements of the U.S. model, of which public research and extension services are only a part, are missing in developing countries. Among the missing elements are efficient factor and product markets in which the effect of resource constraints is made explicit through movements in relative prices.

The farming systems approach is a product of the imagination and professional skills of researchers and extension workers in these countries. It is an attempt to compensate for the lack of an environment supporting technological progress in agriculture. Though it is also identified with the work of a number of the internaional research centers and is closely related to farm management work as practiced in the United States and elsewhere, its full development and application is thus far clearly and uniquely a developing country phenomenon.

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*Director, Office of International Cooperation and Development, U.S. Department of Agriculture

We obviously have here an activity in which U.S. technical assistance would not be grounded in methods and expertise developed and applied here at home. The interest shown in this symposium and the agenda's list of participants suggests that the flow of technical assistance should perhaps be in the reverse direction.

This came home to us in OICD just over a year ago when we were asked to field a USDA team to explore possible technical assistance and cooperative relationships in agricultural research with one of the AID "graduate" countries. The request specified that a USDA expert in farming systems research be included in the team, and that he be prepared to identify U.S. universities having a strong farming systems research program.

It didn't take too many phone calls to determine that there was no such expert in USDA (certainly not in OICD) and there appeared to be no strong farming systems research program in any U.S. university.

I know that the truth of that assertion depends partly upon one's definition of farming systems work. I will not offer a definition now, since we are going to be working together on one over the next two days.

With that caveat, it still seems that the situation remains true today, though a number of the universities are beginning to establish farming systems programs or are strengthening programs which were just beginning last year. In USDA the seminal programs in small farm research in SEA's Northeast and Southern Regions cannot yet be called an expertise in farming systems research. They are a nucleus around which a USDA expertise may develop. This depends largely on the extent to which the methods of the farming systems approach are perceived to be applicable to the small farm programs.

Here we have both our initial motivation for, and a major objective of, this symposium: The increasing interest in the farming systems approach in developing countries makes it imperative that our USDA technicians on overseas assignment be knowledgeable about the concept. Further, this symposium is a good starting point for USDA's exploring the applicability of the farming systems approach to U.S. small farm research and extension. These programs were started out of the belief that the main thrust of our research and extension work is not adequately serving the small farm segment of our rural population.

There are, of course, other objectives. The Office of Agriculture in AID's Development Support Bureau, our third co-sponsor, is planning a project of support to farming systems research and extension programs in AID-assisted countries.

There are still a number of gaps in the plan for such a project which this symposium will help to fill:

1. Is the farming systems approach cost effective?

2. Are there general methodological or implementation issues in the farming systems approach which must be resolved before a broad-based assistance project is feasible?

3. What are the important resource constraints developing countries are facing in attempting to implement farming systems programs?

4. Does U.S. expertise to address these constraints exist in sufficient quantity to give an assistance project credibility?

5. What form of U.S. assistance is most appropriate to the development of farming systems programs in developing countries?

There are some of the questions you will be considering during these two days.

Equally important, the Office of Agriculture is concerned that AID's agriculturists be familiar with the concept of farming systems research and extension. Though the general level of familiarity with the concept probably is higher in AID than in USDA, due to contact with programs in the field, the immediate need-to-know level is also higher. It is AID that is the point of contact with the developing country programs.

Finally, USDA has the objective of looking to the future, so far as our agricultural research and extension agencies are concerned. Requests for assistance to farming systems research and extension programs are certain to increase. What is the response the universities and USDA will and should make? Should we be thinking in terms of some sort of co-ordination? What sort? We'll have the opportunity later to discuss these questions directly.

I agree with the assertion that we do best in technical assistance overseas those things which we do well at home. However, we must always remember that the overseas conditions are not those existing here.

The farming systems approach may be the very device for making that assertion true in research and extension. This symposium will help us make that evaluation.

Overview of Farming Systems Research (FSR)

Donald L. Plucknett

Modern farming systems research (FSR) is becoming an accepted approach to applied agricultural research. FSR was developed because of concerns that farmers were not adopting research innovations being developed by experiment stations. Also, in recent attempts to improve the lot of small farmers, an awareness has developed that there is inadequate understanding of small farmers and their problems.

In a real sense, FSR is not new. Some of the farm management research in agricultural economics in the USA in the past did involve some aspects of FSR. However, a truly multidisciplinary effort involving experimentation in a systems mode on the farm and in focused research on systems problems on experimental stations did not result until recently with the rise of modern FSR.

History

Modern FSR can be traced to a group of individuals or institutions, mostly working in isolation, who began to try to understand several things: (1) how relevant information could be generated for small farm systems, (2) multiple cropping principles and potentials, and (3) the potential productivity of tropical areas. The following examples cited are meant to be illustrative of the range of efforts that have led to modern FSR. Space does not allow me to cover even briefly, all of the important programs. For information on these, I recommend the FSR literature to the reader.

Most famous of the pioneers was Dr. Richard Bradfield at IRRI, who was interested in devising rice-based systems to maximize year-round production in the tropics. He popularized the study of multiple cropping and demonstrated the enormous productive capability of the tropics with careful management. Dr. Bradfield was succeeded by Dr. Dick Harwood and a group of young co-workers who moved away from the intensive research station-based productivity studies of Dr. Bradfield and began to examine more closely the small farm itself. Their work led to innovative on-farm trials and studies of the constraints and potentials of existing farming systems. Later, as they began to become familiar with farm problems, they felt a need to understand more of the climatic and land resources of their target farmers. Dr. Hubert Zandstra succeeded Dr. Harwood about this time and has led a young and vigorous team, including a very well organized and coordinated Asian Cropping Systems Network, in designing and testing methodologies, training and on-farm research.

Another pioneer was Dr. David Norman and a group of associates based in northern Nigeria at Ahmadu Bello University. Their work centered on resource-poor farmers growing millet and other dryland crops. This work was important in dramatizing the benefits of FSR in Africa, in multidisciplinary research team efforts, and in establishing a strong role for social scientists in FSR.

ICTA (The Instituto de Ciencia y Tecnologia Agricoles) in Guatemala, has made a solid contribution to the problem of data collection and analysis on the farm. Closely involved in the work was Dr. Peter Hildebrand who, along with his ICTA co-workers, was responsible for devising and improving the "Sondeo" or rapid analytical survey of the small farm and its problems. Many other FSR programs are beginning to use or modify the Sondeo approach for their own research.

A home-grown regional program that has generated much new thinking on how FSR can be used to improve small farm systems is that of CATIE in Central America, which is headquartered at Turrialba, Costa Rica. This program has emphasized research and training approaches that are suitable for the varied ecological situations and small farm systems of Central America. Most FSR programs vary to some degree, because they must adjust to suit the local physical, social or political environment. For that reason each program has or can contribute to FSR knowledge. Programs that should or could have been listed and discussed in a history of FSR include the ISRA program in Senegal, ICRISAT, IITA, and CIMMYT.

"Upstream" and "Downstream" FSR

FSR is generally seen as being important in helping to improve research effectiveness and relevance. Often this is referred to as "upstream" or "downstream" FSR. The most common definition of these terms is that upstream FSR is seen as "FSR in the large", i.e., that generalized prototype solutions are being sought that may have longer-term impact, while "downstream FSR" is seen as being "FSR in the small" or research that is focused on more problems that appear to have practical, immediate results and benefits.

There is another use for the terms upstream and downstream in FSR, relating to research planning and the role of the farmer in that process. Here downstream activities are seen to be a process of researcher decisions and activities using professional training, skills, intuition and so on, but without involvement of the farmer, in which research products are passed "downstream" to an extension service that is charged with responsibility for marketing the innovation at farm level. By contrast, upstream activities are those where maximum intelligence, including the wishes, decisions and concerns of the farmer, is used to focus research on real farm problems. In this sense upstream FSR can be used to focus on problems facing farmers now, or those which are most likely to face farmers in the future.

Characterizing different activities of FSR

Many people have had difficulty in understanding what FSR is and how it differs or coincides with "conventional" agricultural research. In part, this is because the terminology of FSR is not fixed nor agreed upon, and new terms keep being coined. However, a greater problem, in my opinion, is that there are different areas of activity in FSR that need explanation and specification, if FSR is to be understood. The TAC Review of FSR at the international agricultural research centers (IARCs) recognized this problem and proposed a conceptual framework for understanding and conducting FSR. The TAC Review suggested that there are three "Activity Areas" of FSR; Base Data Analysis, On-Farm Studies and Research Station Studies. These activity areas can be defined in part by where and for what purpose the research is to be conducted. Also, the balance between the Activity Areas is usually determined by the stage of development and needs of the individual FSR programs.

1. Base Data Analysis. This involves the collection, collation and understanding of the many factors characterizing the environment of a region. Much such analysis will entail exercises in land resource mapping and evaluation, and in large part can be done at research stations or in head offices, mostly relying on secondary data. In addition to physical resource information, there is also a need for socioeconomic data on population, farming systems used, production and income levels, and various aspects of the infrastructure. The purpose of Base Data

Analysis is to learn as much as possible about the land and water resources of a region, as well as socioeconomic factors, and how these physical and social factors influence agricultural production. The normal end product of the physical resource analysis is a series of maps depicting agro-climatic zones, land/soil units, and land use (farming/commodity systems). Such information can then be used to assist identification of potential target zones for on-site study and to determine the best locations for experimental stations or benchmark sites, as well as providing a basis for later studies on research impact. In general, Base Data Analysis will seldom involve detailed on-site investigations except where larger non-farm units (for example, villages) are the object of study.

On-Farm Studies

On-Farm Studies can be used both to improve research planning and focus, as well as assist in finding uses for improved technology at farm level. Thus, On-Farm Studies may be used to gather information on systems as they are; to conduct research on new innovations on the farm, either under researcher control, joint researcher/farmer control, or farmer control; evaluate adoption of new technology; monitor changes in farming systems; and assess impact of new technology. It should be pointed out that On-Farm Studies includes experimentation on the farm, in addition to more conventional surveys; such experimentation does raise some methodological problems. On-Farm Studi: a great opportunity for cooperation with local extension services or institutions.

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Research Station Studies are seen to involve a focused research program to generate new technology, design components for new systems, or modify existing systems. Such research differs from conventional, on-going disciplinary research in that it is designed to fulfill a need in the context of a given farming system. Sometimes it may be useful to distinguish different classes of Research Station Studies, for example: (1) exploratory, developmental research aimed at solving specific problems. Once the problem is defined in an FSR context, its solution may have a largely disciplinary-oriented basis (i.e., a reductionist framework); (2) integrative studies, where component parts are assembled and tested in a holistic framework, i.e., the synthesis of research results into applicable systems and management practices.

Subdivision of FSR into three activity areas can be useful in helping persons to understand just where particular FSR programs are focused or oriented.

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AN OVERVIEW OF FARMING SYSTEMS RESEARCH METHODOLOGY [1/]

Richard R. Harwood

Rodale Press, Inc.

Historical Perspective

The person being newly exposed to the broad spectrum of farming systems research (FSR) approaches used in third world agriculture will immediately face a new vocabulary and a bewildering assortment of approaches. Worse yet, in reading the literature (mostly in mimeograph or annual report form) of the last five years, one finds rapid changes or evolution in approaches if not philosophy. Because of the newness of the approach, that change rate may even make what is seen in a field visit seem at variance with the latest available repor from those trials.

Modern day third-world FSR really began with the work of Dr. Richard Bradfield in the late 1960's as related by Don Plucknett in the preceding paper. During the early 1970's this approach was "institutionalized" and adapted to the Asian network during the time when I coordinated IRRI's program. Since 1975, there has been widespread adoption and refinement of the basic principles of FSR throughout much of the third world. It is fitting that this approach has now "come home" in our attempt to address today's problems in the U.S. The relationship of today's methods and approaches to the work of the 1930's and 1940's in the U.S. is in name and concept, but the methods are not really very similar. I can say with certainty that the methods used in FSR for third world systems, being very much adapted to third world institutional, social and technological environments cannot be adapted without major change to the U.S., but American scientists planning to work in the third world or even those planning FSR work in America can well profit from exposure to those methods.

Types of Farms where a Systems Approach has Benefit

Not all farming systems types afford equal payoff to holistic studies. In single-enterprise agriculture such as in dryland, continuous wheat or in monoculture corn production, the single enterprise has a particular fit to its environment. There are relatively few variables which interact. Those interactions are continuous and can be approximated nicely with relatively simple linear models. The introduction of new technologies in production methods can be done

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empirically, as few options exist, and changes are quantitative rather than qualitative. Traditional, experiment station-based trials of component technologies can meet many of the needs of such systems. But where environmental gradients are sharp and where farming systems have many component enterprises with strong interdependencies, the improvement of productivity requires not only better production components, but an understanding of "what fits where." Impirical testing here translates into a highly inefficient "hit and miss." Effective technology development and targeting in such a complex environment where integrated systems must optimize use of scarce production resources requires either a method for progressive understanding of the systems by a broad segment of development workers, or the availability of that rare, widely-experienced and gifted scientist with keen insight and intuitive understanding. We must therefore make use of a procedure which will empower we lesser mortals to acquire and use, hopefully early in our careers, similar insight in dealing with complex systems and their environmental interactions.

The Spectrum of FSR Approaches

Modern day FSR for third world countries began under the sponsorship of the larger, centralized research institutions. Their roles and structure, being somewhat different from those of national programs, encouraged an FSR approach peculiar to their own mission and capabilities. In studying the various so-called FSR programs of today, one finds variation due to many other factors as well:

1. The stage of development of the particular program. A complex program does not all of a sudden appear in complete form.

2. The degree to which the program has been thought through conceptually. Some programs may be merely copied from a different setting and environment.

3. The resources that have been commited (or not committed).

4. The degree to which an ongoing program has been renamed or slightly modified and the FSR terminologies applied because of "fashion," "trend" or availability of funds.

Variation across programs generally can be traced to three categories of differences in objectives or "mission" of the FSR program.

1. The overall purpose of the research:

Is the program a study-and-learn program or is the program ultimately to result in change through an extension process for a sizeable geographical impact area? In the first instance a cross-section or sample of "target" farms will be chosen based primarily on type of farm. There will not be undue concern over the extent or size of the geographical area that they represent. If an eventual extension program is the ultimate goal, the program will be structured first according to parameters which define the target area and secondly, according to representative farm types within that area. Early FSR programs focused on the first approach, but

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by the mid-1970's the programs with a front-line development mission and thorough conceptual base began to focus on definition of target areas. The concepts of farming systems "determinants" and agro-production complex came into being. Today's better programs first identify target areas across which one or more identifiable farming systems types are present, and then proceed to study and change those characteristic types.

2. The change which is envisioned as resulting from a program.

Most programs are carried out on the premise that FSR studies will encourage an understanding of the farming system, but that understanding will not, by itself, lead to improvement in the systems. New and appropriate technology will have to be introduced, possibly with some change in structure in the system, in order for impact to be made. Where a single commodity is predominant such as in many maize, wheat or rice-growing regions, the FSR may be truly systems-oriented but will focus on change of the predominant enterprise in the systems of its target area. The change focus will depend largely on the technologies ava lable to the FSR institutions. Those may be a single agronomic crop, a group of such crops, agronomic crops associated with a major crop, horticultural crops, tree crops or one or more animal components. Rarely will an organization have sufficient expertise (or in fact mandate) to try to change all of these components. The IRRI program, for instance, worked on about one-half dozen agronomic crops which normally fit around upland and-lowland rice. It occasionally worked with one or more horticultural crops. No work was done to add animal technology. Indications were given when changes were needed in animal types, numbers or feed availability. Some of these differences in scope have been somewhat inappropriately labeled FSR "in the small" vs. "in the large."

3. The extent to which the FSR is used as an overall institution-building tool as opposed to a mere development tool.

On-farm FSR studies can be extremely useful in staff training, in serving as a vehicle for cross-disciplinary studies, in bridging the gaps between national institutions, in linking national and regional programs, in fostering problem identification and feedback, and in strengthening the research-extension linkages. With these more broad goals, the methods and approach will be somewhat different.

A fourth difference in methods can be traced to the level of support a program received. The more complex methodologies and the detail of systems documentation possible for large, well-staffed programs is clearly not possible or even necessary in national programs whose success is measured in terms of development rather than in terms of "learning" or publications.

The Goals of a Regionally-focused National Program

I will concentrate my discussion on the national FSR program and in particular that part of the national program having area-specific responsibility, as I assume that most interest and participation of American scientists will be in these programs. The goals for FSR in such programs are broad [1]. The primary end goal, linked closely to the research itself, is agricultural development of a particular geographical region or district. Success or failure of the program is evaluated by various development indices. While the program may be called a research program, it has a responsibility for extension linkages, outreach testing and verification,and successful implementation of the recommended technology. The primary goal includes an element of successful extension. Research responsibility is thus expanded to include the region-wide verification testing or so-called "applied research" phase.

A second goal is to arrive at an understanding of the composition and function of key types of farming systems in the target area. With present status of the better national programs, this goal is reached by the immediate study team but there is a noted lack of effective conceptualization and articulation of that overview of the systems' structure and function. Transfer of systems information and of the often intuitive understanding of the production systems is at present very limited. The effectiveness of the present programs depends upon the pinpointing by the immediate study team of specific technological needs which can then be delivered by traditional methods. The ultimate methodology would be the effective relaying of an understanding of the systems to enable a broader participation of the national development team in analysis and decision-making.

Other goals have been previously mentioned. The need for practical, on-farm training of scientists at all levels has been overlooked for the past decade or longer. Many if not most of today's scientists, either in developed and third world countries, have had little or no professional experience in a farm setting with immersion in its complex patterns of management and environment. It seems incredible that we scientists profess to employ the scientific method without a first-hand knowledge of what we are supposed to be researching. I know few crop production specialists (other than those of the present FSR generation) who have ever participated in farmer-collaborative trials. FSR provides excellent staff training opportunities.

Linkages between development institutions, departments and even ministries,or between national and district or regional divisions is facilitated in on-farm research. The farmer's field is the common ground that unites most development agencies. It is "neutral turf," belonging to no agency.

Finally, the research-extension linkages can be maximized in on-farm research. Extension specialists should participate in the on-farm research. Verification trials are then often used for extension demonstration purposes, with the research and extension functions being intermingled.

The Regional FSR Organization

Others have concentrated on this subject in the workshop, but I would like to make clear the type of program I am referring to. The methods that I will describe are used in FSR for a particular regional target area. They may be for an area development program, a district or provincial level program, or for any program having specific area development responsibilities preferably within a single political or administrative development unit. The FSR would be co-ordinated by the agency with lead responsibility for providing technology for the area. In other words, the FSR should not be conducted by a separate team, with information relayed to a different organization or ministry for the eventual providing of technology. With information transfer currently being the weakest link, the need for such transfer should be minimized. This regional, area-specific orientation must be distinguished from the centralized, national program which may have as its first goal the understanding of the major systems and their technology needs in order to properly orient centralized development of technology. Area-wide extension and development is thus secondary in purpose.

Methods for Area Targeting

Target development areas are normally chosen from considerations other than those based on agro-production complex definition. Effective FSR depends on the ability to identify particular farming system types which respond in similar fashion to their environment, which have relatively similar internal interactions and which represent relatively large production areas. Improved technology to fit those systems is then verified across the target areas in systems of similar type. Such types are limited in geographical area by combinations of environmental determinants which may be socio-economic, physical or political. Combinations of determinates which give rise to similar types of farming systems define the agro-production complexes across which FS information can then be extrapolated. The two approaches to defining such complexes are first, to simply survey the farming systems to identify similar types. The geographical extent of those types then is assumed to be the production complex. A second approach is to identify the major determinants and to then define the production complex in terms of determinates.

My own observations have found different methods to apply depending on the nature of variation in the particular area. In upland, gently rolling, subtropical areas the physical parameters of rainfall and elevation combined with distance from market are predominant. With such patterns of variability on a macro-scale, simple identification of farm type can serve as an indicator of production complex. In the humid tropics with systems involving lowland rice, production complexes are determined by similar macro-determinants, but also by "micro-determinants" which change even within farms. Paddy size, shape and elevation determine the eventual cropping pattern. Technology is targeted on a district basis by macro-determinant and then specified at the local level according to type of paddy (which is easily classified by the research or extension worker and farmer).

A third and somewhat more complex method is to define environmental gradients and to determine how systems (or technology) change across those gradients. In actual field practice, however, the boundaries tend to be rather discrete. Treating them as such, at least, simplifies the process.

While precise determination of agro-production complexes is impossible and to the newcomer seems highly subjective at best, their effective determination is crucial to FSR and to the extension phase which must follow. FSR without prior targeting and identification of the production complex is purely impirical and is neither efficient nor cost-effective.

The Farmer Participant Approach

Much has been written about farmer collaborative research as it has become popular in the past few years[2]. The key element is the farmer's participation in the entire on-farm research process. The basic approach was designed in the early 1970's as a combination of the Chinese "learn from the masses" method and the western, top-down method that most of us were trained in. The theory is that both farmer and scientist have particular skills to contribute to the learning (research) process. All too often, however, in actual practice the farmer is "used" in FSR as a mere laborer rather than a full participant. The truly collaborative relationship is an extremely sensitive one depending on human relationships. It requires a very particular attitude, personality and training on the part of both researcher and farmer. Effective farmer-researcher interaction is both highly satisfying and profitable, but to those trained exclusively in the top-down philosophy such relationships are difficult to achieve. One may even hear the comment: ..."we are wasting time attempting to learn from farmers." Others may go overboard, losing confidence in their ability to teach farmers anything. The proper relationship and balance is essential.

Systems Description and Problem Identification

Once the target areas have been chosen, and the FSR team selected, the initial research phase is that of description. The most effective method to date for starting that process has been the rapid survey on "Sondeo" method[3]. It has many advantages which will be covered in later papers. Basically it consists of a rapid, reconnaissance-type survey by an interdisciplinary team which will be eventually working in the area. At the end of the 5-to 7-day survey, a final descriptive report is written on the farming systems types of the area. The interdisciplinary makeup of the team, their commitment to the area and the requirement for rapid conceptual analysis and summary are crucial to the effectiveness of the process. All too often the surveys of different methods are conducted by separate groups of specialists, with analysis being time-consuming and eventually failing to provide a clear, conceptual understanding of the systems - the communications problem. The Hildebrand method represents a tradeoff between objective measurement, quantification, and intuitive understanding and perception. It is by far the most effective

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approach. It may even be desirable to do the survey in two stages, with the first stage being a reconnaissance survey across several villages of the target area. This rapid once-over would give indication of the variation in type of farm across the target area and may take as much as two to three weeks. From that variation the specific types of farms to be targeted by the FSR would be chosen. Farm size, types of enterprises and development level for FSR focus would be decided. A decision would be made on villages for the FSR effort, based on predominance of the desired farm type as well as cooperation from local village heads, availability of housing, access and other criteria. The detailed, one-week follow-up Sondeo would then be conducted. This study constitutes the "benchmark" and focuses on systems description, productivity, problem areas, and potential for change.

In a regionally-focused development program, the survey team should be led by a member of the lead development agency who should probably be a field-experienced social scientist. The team should include crop production specialists, a plant protection person, a soils person, and a member of the regional extension service. About six team members usually seems adequate. Many of these people should be destined for assignment to the FSR teams that will work in the area. The other survey members can be drawn from the central research organization and stations that will be backstopping the FSR team. This experience is invaluable for staff training and for forming the personal relationships vital to communications between locations and agencies. It is during these surveys also that the tone is set for the "joint learning experience" between farmers and researchers that characterizes FSR.

The detailed surveys should uncover serious problem areas. Many of these are identified by farmers themselves, but the survey team, since it includes production-trained scientists who are familiar with the best available production technologies, has some knowledge of what might be possible for the survey environment. Hopefully those standards for comparison would come from physical environments which at least are not vastly different from that of the study area. If one of the team members has international experience from similar areas in other countries, the problem identification might be especially keen. At this point, however, the process is highly subjective and dependent upon the skills and training of the team, and on their ability to communicate effectively with farmers.

The immediate product or output at the end of this 3- or 4-week survey process should be a series of conceptual descriptions of farming systems types and their prevalence for the agro-production complex. The selected target types should be described in detail, with some quantification of production levels, income, farm structure and other relevant factors. Detailed lists of the more important production problems and best estimates for improvement potential will be made.

Locating the Study Team

Once the surveys are completed, the study team is located in the area. In most cultures it seems best if the team members are of the same tribe or ethnic grouping, but whose homes are beyond easy travel distance from the research site. It seems best if the study team can be located within one of the study villages, removed from location in a sponsoring institution. This maximizes contact with farmers. The farmer linkage is usually more difficult than linkage back to the research station or parent organization. A small, rented house in the village is ideal, where team members can live and where a small office, supply storage, and work area can be provided.

In many countries the two to five team members are supplemented by "village assistants" who are usually teen-agers from the villages hired to help in the project. They become team members and identify with the research team. They are valuable in village level-research linkage and with farmer-research linkages, since they are village members and are well-known in the villages.

Systems Design

This is an often misunderstood phase. The "design phase" simply is the overview and anlysis of the systems, and the projection of possible changes in the system based on available technology. Higher level research scientists may well be used during this phase, but care should be taken that they do not completely overshadow the study team. During the design phase, the team never "redesigns" the entire system. They simply program stepwise or single element changes in the system that should lead to their impovement. Participant farmers should play a major role in this process, and have a degree of (but not absolute) veto power over it. Some FSR people have been hesitant to introduce change and may wait for a year or more before doing anything to alter the system. *This is a very serious mistake.* First of all, one learns much faster by doing. Secondly, the farming system is much better understood when you see how it can or cannot be changed. Most importantly, the FSR team should *never* be allowed to remain in the village as merely observers. They will develop a reputation for laziness or as observers, not doers. The initial changes should be small, but they should be tried. A variety trial is an ideal icebreaker and is noncommittal. Simple changes in row spacing, weed control or a few rows of a well-tested new variety across a field are all "safe" options for initial design changes. An experienced team with good backstopping and technology from similar environments may attempt changes in the crop rotation on small areas in the first year.

The design should be upgraded year by year as test results come in. As one or more adventuresome, high-management farmers are identified, more adventuresome technologies can be tried. It is very important for the FSR team to make an early contribution, to have "a winner." That can be small, but it should come early. This lays the groundwork for more adverturesome types of trials in subsequent years.

Testing Methods

Much as been written about on-farm study methods[4,5,6]. I will only briefly summarize them. As in all FSR, field testing goals must be clearly defined. The approach to be used as well as the field design depend upon those objectives.

There are three basic field methodologies: farmer-managed trial. the "superimposed" trial, and the research-managed trial. In farmer-managed trials, the farmer conducts all of the operations in crop or animal production. The treatment units are usually large enough to make them economic units. Researcher participation in such a trial is limited to design, monitoring, perhaps some management advice and at the end, recording of yield. This trial is used where the farmer's management skill is either needed for successful completion of the trial or is actually under test as a part of the new technology or where economic data are needed on labor use.

The superimposed trial is one where the farmer manages the field but the researcher imposes a particular treatment on subplots. Fertilizer, weed control, insect control or other variables may be superimposed, with the farmer managing all other factors across the plots and the entire field. This is done with minimal disruption of the farmer's system. It measures the effect of incremental changes in technology as applied to farmer management.

The final type, the research-managed trial is used where a completely different management is needed, where small plots are required, where many variables are involved or where high-risk or low-yield treatments are used. Most statisticians favor this approach as it gives maximum statistical precision. It has the disadvantages of requiring large amounts of staff time and doesn't take advantage of farmer-management expertise.

In all arguments over method, the FSR person should always clearly state his research goals for a particular trial. The goal determines the method to be used, with the requirements for statistical precision being secondary. The needed precision can usually be achieved with any of the methods if proper design is used.

Analytical Methods

It is important that the field study team do the initial data summaries, using simple hand calculators if necessary. It is crucial that they have a feeling for research results soon after the data are collected. At the beginning of the trials the summary methods should be determined, with forms printed and available for all data summaries. The staff must be trained and disciplined to accomplish this quickly. If needed, a person from the headquarters station can come down to the field to help with these summaries, but *they should be done in the field.* Further, higher level analysis can then be accomplished by other staff at a central location after initial summary reports are done by the staff. It is important also that all staff in the field be familiar with results from all trials. With division of responsibility among team members and heavy work loads, there is a tendency for breakdown in communications.

Verification Testing

Following two or more years of successful research testing of new technologies, (with participation of extension staff in the research) the trials are then carried to similar farms in representative areas of the agro-production complex. The role of extension becomes progressively more dominant as this phase is entered, as these trials usually will serve as demonstration trials prior to an all-out extension effort. A regional extension person will usually have been assigned as a member of the FSR team. He will have trained other extension workers in the technology and its testing in the research villages. The extended verification testing may be done either under extension or research direction. There will almost always be research participation by member of the FSR team, whose role has begun to change. In the verification stage, the options are limited in number and the trials simple but in many locations.

Linkages Across Agencies

With village-level research, linkages are almost always easier. Different research divisions representing different disciplines, or even different ministries can be brought together on common ground. While problems can still exist, my own experience has indicated that communication is almost *always* easier in the village or in the farmer's field than it is at the institution level.

I find also that the discussions of problems of interdisciplary research are more relevant to the U.S. than they are to third world situations. Those difficulties are in direct proportion to "academic" level, being greatest in an American university setting, intermediate in third world academia where promotion is seldom based strongly on quality of published documents, and minimal in the line development agencies with field responsibility. At the field level promotions and pay scale in a third world situation almost never are influenced by publication. They are, however, often influenced by distance from headquarters, so just being assigned to a remote location may be detrimental. I find much of the American-based discussion about interdiciplinary problems and the problems of publication for promotion nonrelevant to regional field programs in the third world. The scientists assigned to village-level programs are not highly specialized. They do "some of everything" as is needed in the village which may include helping to fix the roof of their participant farmer or to buy and administer vaccine for his sick cow.

Linkage and communication problems are minimized within the village-level team. Communications back up the institutional or bureaucratic chain are more difficult, requiring good program leadership.

Production Programs

The ensuing region-wide production programs from such an approach will have had broadly-based research input. Most of the concerned agencies should have been involved during the various phases of the FSR and verification testing program. All should have a conceptual understanding of the farming systems to be targeted.

The role of the FSR team has now changed to that of trouble-shootin on the technology. They should be free to travel and to monior the new technology as it is applied. The greatest danger in a production effort is the attempt to apply new technologies beyond their area of adaptation. Production programs must be first targeted to the specific production complex defined by macro-determinants. The adjustment to micro-determinants is dependent upon the clear identification of thosedeterminants in the field by both farmers and extension workers. For example, in the terrace agriculture of Nepal's hill rice areas, the extension of the new wheat varieties for wheat-rice rotations is highly dependent on proper identification of field or "paddy" types. The identification is simple, but requires training of extension workers and farmers alike, and labeling of the package of practices according to needed paddy conditions. The FSR team should trouble-shoot this application process during the production effort.

The Need for Strong Leadership

FSR programs have greater leadership requirements than do programs for testing of simple component pieces. The demands for conceptual understanding and clear establishment of goals and priorities require a much stronger and intensive management function of the project. Without this leadership the field-level, middle-skill scientists will be lost in complexity. I feel that this management area is a perfect application for the talents of expatriate scientists *if they are highly trained and experienced in FSR methods*.

Following goal-setting and conceptualization in importance to the FSR team is the necessity of judging the scope and amount of work to be attempted by the FSR team in the village. The tendency is *always* to attempt more than they can do well. Village-level work, if it is effective, has a dramatic effect on team members. Morale, dedication and empathy for their farmers become extremely high in a good team. It requires a high level of management skill by leadership from above the village team level to limit and shape the activities of the team to coincide with their skills and training.

Summary

FSR methodologies are newly emerging, conceptually complex and quite different from most approaches used in the past. The conceptual differences are crucial to their success. The scientist being exposed to them for the first time should seriously attempt to sense and understand those concepts and differences. The application of FSR in its broadest sense as related here, has received wide acceptance in third world agriculture. That acceptance by third world development leaders, concerned with the broad aspects of both institution-building and area-development programs, has preceded widespread acceptance by the more tradition-minded scientific community.

I do not see FSR as "the" answer to agricultural development. do see it as a very important tool, among others, which can play a central role in development efforts.

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OVERVIEW OF THE POTENTIAL APPLICABILITY OF FARMING SYSTEMS RESEARCH TO U.S. SMALL FARMS AND U.S. RESEARCH AND EXTENSION

by

Art Hansen
Department of Anthropology
University of Florida

Paper presented at the Symposium on Farming Systems Research (December 8-9, 1980) in Washington, D. C., co-sponsored by the Office of International Cooperation and Development and the Science and Education Administration of the U.S. Department of Agriculture and the Development Support Bureau, Office of Agriculture of the U.S. Agency for International Development.

Introduction:

We are examining farming systems research (FSR) from two perspectives: (1) as experts in one or more aspects of agricultural change, and (2) as employees and officials of different bureaucratic organizations. The examination is both theoretical and practical. Theoretically, what is the logic behind FSR, and what should it do? In practice, how does it really work? Those of us with actual field experience with FSR must describe how it helps us, and what are its costs as well as its benefits? In the end, as experts and bureaucrats, do we want to use an FSR philosophy and methodology?

In examining the applicability of FSR to the U.S. and to research and extension programs oriented toward small farms, we must start by being very clear about our evaluation of existing and past small farms programs. Are they working as we want or not? Where do they work, and with whom? What kinds of farmers and farm problems are handled the best and the worst? Do we think that FSR could theoretically do a better job? Would we ourselves work better, and would small farmers be better off, if we worked through the FSR process? In performing this evaluation, we must remain constantly aware that we (the expert evaluators) owe our jobs, our professional careers, and a great deal of loyalty to our governmental agency or land grant university. These are the selfsame agencies and universities that have masterminded or ignored American small farmer programs in the past. This paper is not designed to judge these bureaucracies and programs nor to sell FSR. Each of us, and the group that is assembled, must wrestle with our own evaluations and recommendations.

FSR Surveys in Alachua County, Florida:

Most of my own experience since the mid 1960s is international: Bolivia, the Dominican Republic, Zambia, and Malawi. Only since 1978 have I begun to work in Florida with small farmers. This last spring a multidisciplinary group of Florida faculty, led by Pete Hildebrand, taught a course in FSR methodology to a multidisciplinary group of graduate students. We took them out in our county to conduct a sondeo or rapid reconnaissance, then we analyzed together the small farmer situations they encountered, and finally planned possible interventions. At the end of the class, its findings and recommendations were presented to an audience that included county small farmers and an extension agent.

This past summer Elon Gilbert, an agricultural economist, and I extended our knowledge of the county by supervising a set of FSR surveys[1] (Table I). The core survey was a random sample of operators of agriculturally assessed land. For the single county we were trying to work out what kinds of systems exist and their frequency, while at the same time testing FSR survey methodology.

In addition, we supervised three surveys of production and marketing practices for specific commodities: beef cattle, watermelons, and squash. These FSR studies "in the small" were designed to illuminate differences between low and high resource farmers and to point out potential areas of under-utilized or mismanaged resources for future research and extension. Reports of these four surveys will be published in January 1981 (Hansen, Griffith, et. al. 1981; Gilbert, et. al. 1981).

TABLE I

ALACHUA COUNTY FSR SURVEYS

Purpose

-describe existing systems/practices

Types

-general verification of county farming systems

-specific study of production and marketing for different commodities

Personnel

-faculty and graduate students from: agricultural economics, agronomy, animal science, anthropology, education, entomology, history, and vegetable crops

-county extension agent

Advantages

-broader comprehension:
within a commodity
among commodities
farm and off-farm

-reality testing

-research flows into extension

Faculty and graduate students from eight departments, as well as a local extension agent, were involved in planning, carrying out, and analyzing the four surveys. This is really the major reason why I personally became involved in a domestic program. These domestic, in-state operations are the best and cheapest way to train people in FSR--our graduate students, fellow faculty and agency colleagues, and visitors from other nations may receive hands-on, do-it-yourself experience and skills right in our own backyards. At the same time, we may more easily and quickly test and evaluate FSR methodologies in these in-county programs, as well as call upon the accumulated expertise of all our agencies and universities.

We who participated in the spring and summer projects are now convinced that the multidisciplinary FSR method is very rewarding. Without tackling the cost-benefit analysis of these rewards, the interplay of agronomists, animal scientists, anthropologists, entomologists, economists, etc. kept all of us constantly aware of the complexity of the conditions that farmers face and the complexity of the farming systems that people create to cope with their environmental conditions. Other advantages of FSR were the constant testing of our ideas with county realities--including extension agent and farmer input throughout our research kept us from becoming too theoretical--and the flowing together of research and extension as extension agents helped plan and question research, and as researchers got out onto farmers' fields.

County production is quite diverse, and there is a lot of heterogeneity in farming systems. We made sense of this by first dividing farms into three major production strategies: (1) livestock-centered farms in which crops (other than pasture and feed) are absent or minimal elements; (2) crop-centered farms in which animals are absent or minimal; and (3) mixed or balanced farms in which animals and crops are about equally important. Within these major strategies we differentiated systems and recommendation domains by separating a few key enterprises and splitting low and higher resource farmers. At the end we had the nine systems shown in Table II.

TABLE II

COUNTY FARMING SYSTEMS AND RECOMMENDATION DOMAINS

Livestock-Centered Farms

1. Beef-centered low resource farmers
2. Beef-centered higher resource farmers
3. Non-beef livestock-centered low resource farmers

Crop-Centered Farms

4. Horticultural crop-centered low resource farmers
5. Specialty crop-centered low resource farmers
6. Agronomic crop-centered higher resource farmers
7. Agronomic and horticultural crop-centered higher resource farmers

Mixed or Balanced Farms

8. With tobacco higher resource farmers
9. Without tobacco low and higher resource farmers

In our surveys we found that farmers (like many other people elsewhere) did not like to tell their income. This research problem is confirmed for the U.S. by Lola Smith, a colleague with extensive research experience with family farmers in this country. Since income data was not readily available, we used acreage and herd size as the criteria for defining small or low resource farmers. We categorize people who operate less than 101

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acres or, if livestock-centered, fewer than 50 head of livestock as Low Resource Farmers (LRF).

Fifty per cent (54%) of our random sample of county farmers are low resource, a percentage that agrees fairly closely with U.S. agricultural census statistics. It must be clearly pointed out that these people who practice a low capital agriculture are not necessarily poor people. In fact, the relative absence of obvious poverty among the surveyed low resource farmers is a surprising finding of our survey.

In many other ways, however, the Alachua County low resource farmers do fit the common assumptions made about American small farmers (Table III). Their land resources, although small, are under-utilized: only 55% of the land they control is in pasture and crops, while much of the rest is still in woodland. Our three commodity-specific surveys also show that these farmers are producing much lower yields, in general, then higher resource farmers.

Low resource farmers in our survey are part-time farmers: off-farm income and commitments are very important, perhaps more important for most of them than on-farm income. Those who are not working off the farms are often old and retired. Time and energy, therefore, should be recognized as limiting factors. Most of them are involved in farming systems that require little management.

By far the most popular strategy for low resource farmers is being livestock-centered, probably because of its low management needs. This means that county research and extension programs that want to work with the

TABLE III

LOW RESOURCE FARMERS IN COUNTY

(<101 acres, or <50 cattle)

Frequency

54% of all farmers in survey

Land Utilization

55% in pasture and crops

Time and Energy

61% are part-time farmers

39% are 60 years of age or older

Production Strategies

63% livestock-centered

22% crop-centered

14% mixed or balanced

Orientation

46% interested in growth of farm

41% want stability

12% in decline

51% receive both income and subsistence

17% only income

24% only subsistence

majority of the present low resource farmers will need to concern themselves with livestock and forage rather than agronomic or horticultural crops.

Less than half of the low resource farmers in our survey are growth-oriented, i.e., oriented toward increasing their production and profits. Almost as many are more interested in stability, neither risking, gaining, nor committing more to their farms. About one in every ten are reducing their involvement or getting out of farming completely (in decline). More than half receive both subsistence (largely from gardens and livestock) and cash income from their farms. Another one fourth only get subsistence, while only 17% receive only cash income.

Putting these together, it means that many of the sampled low resource farmers are not really profit-oriented in terms of their farms. In general, they want to live on a farm. Subsistence is important because it cuts their living costs, underwriting the desirable rural life. They may have inherited or purchased the land but that is not their real income-earner. Many put something in the ground or run a few animals because they like to do that and because they need to amortise their farm life by getting an agricultural assessment to lower their taxes. Only some are really interested in working harder on their farms for immediate income growth. and others want long-term systems to set up their farms as self-sufficient, often looking ahead to retirement.

FSR at the University of Florida

The surveys we have described are part of the first phase of establishing through the University of Florida an in-state FSR program to work with Florida's low resource farmers. Before elaborating on this specific program, it is important to note the broader involvement of people within the university community (faculty, students, and administrators).

TABLE IV

FSR AT THE UNIVERSITY OF FLORIDA

-faculty and graduate student core
-sack lunch and seminars
-courses (especially methodology courses)
-collaborative research/instruction
-minor in FSR
-administrative support
-some outside funding
-FSR/E small farmer in Florida program

Core people in FSR activities at the university are faculty and graduate students who are dissatisfied with current disciplinary--specific and commodity--specific approaches. There is an informal sack lunch for the Social, Agricultural, and Food Scientists Study Group every week that provides a way to communicate with each other about our interests and up-coming research, courses, conferences, etc. Occasional seminars are sponsored by the FSR group, and several courses are taught, such as the field methods, hands-on course mentioned earlier. Multidisciplinary teaching and research projects, such as the low resource farmer surveys mentioned above, are set up and staffed by the faculty and graduate students from this core, occasionally supplemented by others when other disciplines are needed.

Recently, to formally recognize the existence of relevant courses and strong student interest, we have established a minor in FSR. Administrative

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support and some outside funding have been secondary in the past to the faculty and graduate student interest, although that support and funding are now increasing.

Right now, spearheaded by Pete Hildebrand, we are setting up an FSR/E (research and extension) program to work with Florida's low resource farmers. Although focused on domestic farmers, the staff and programs will be available for use in training, planning, and evaluation of international FSR projects as well.

The program structure is outlined in Table V. A coordinator will report to the Office of International Programs, Institute of Food and Agricultural Sciences (IFAS), and the Deans for agricultural research, extension, and instruction. An advisory council of department chairs and a technical committee of relevant faculty will work with this coordinator on general policy and specific projects, respectively. In the Florida counties targeted for work, an advisory committee of county extension agents will be involved in planning and implementation, and in those counties an FSR/E field team of scientists will identify and work on tests and trials for specific systems and commodities in collaboration with local agents and farmers. For more information on this, please contact Pete Hildebrand, the acting coordinator.

TABLE V

UNIVERSITY OF FLORIDA DOMESTIC FSR/E PROGRAM

```
International Programs and R/E/I Deans
                                 |
Advisory Council --- FSR/E Coordinator
 of Dept. Chairs                 |
 (Departments)                   |
                                 |
           Technical Committee --|
              (Faculty)          |
                                 |
Advisory Committee --------------|
 of County Agents                |
 (County Extension)              |

                     FSR/E Field Team
```

International and Domestic Comparisons:

In working with low resource farmers in Florida, it became rapidly apparent that there are major similarities with Third World situations. But rather than dwell on the similarities, let me point out some equally important differences (Table VI).

TABLE VI

INTERNATIONAL - DOMESTIC CONTRASTS

Domestic Small Farmers

-heterogeneous (in survey)
-not as committed nor as dependent
-not as poor nor as isolated
-more mechanical skills
-not as significant to country

Research and Extension

-extensive fund of knowledge
-developed infrastructure
-insiders not outsiders
-we have met the enemy ...

U.S. low resource farmers are very diverse, as our sample shows. There is no widespread homogeneity to improve the cost-benefit performance of FSR work. They are part-time, part-committed, and part-dependent on agriculture. We cannot automatically anticipate that these farmers will commit more time to farming even if we show them improved technologies. Also, at least in our county, low resource farmers are not primarily the poor and isolated people that are the stereotype. In Alachua County, small farmers include airline pilots, shop owners, university staff, etc. Less than ten per cent are obviously poor. What this means is that low resource farming does not necessarily mean that the farmers are completely low resource people, only that they have committed few of their resources to agriculture.

Another significant difference is the importance of low resource farmers to the country as a whole. The U.S. farming population is only 3.5 to 4% of the national population. If we assume that 60% of them are low resource, that is only 2.5% of the country. In contrast, in other countries this population may be so large that small farm research and extension are needed to vitalize national agricultural production or prevent massive dislocation, unemployment, and welfare problems.

There are other critically important differences between the research and extension environments in which farmers operate. We have in this country a lot of agricultural, socioeconomic, and political data to buttress our domestic programs. Institutions for communication, marketing, research and extension are well developed here and we know these institutions as insiders.

We are the native informants, the host country nationals of the agencies and universities that are responsible. Here again we must remember that we are bureaucrats--the officials and employees of the research and extension institutions that are responsible for much of the available data and many of the programs. If they are insufficient or misguided, we cannot shift the blame to "the natives", for we are they.

Footnote:

1. The surveys were funded by grants from the Center for Community and Rural Development and from Sponsored Research, University of Florida.

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THE ALLEGHENY HIGHLANDS PROJECT

The Allegheny Highlands Project was an experiment designed to test the effectiveness of a method for delivering a package of technological information to farmers as a means of promoting rural development. The Project began in 1970 and terminated in December 1979. The Project was supported by West Virginia University and by two grants from the Rockefeller Foundation.

University personnel assigned to the Project consisted of an agronomist, animal scientist, farm economist and veterinarian who worked together as a team to provide individual recommendations to cooperating farmers located in a 9-county area of central West Virginia. In addition to the 4 staff members listed above, there were also assistants in each of the discipline areas, a resident panel consisting of 5 faculty members located on the campus of West Virginia University who provided support and liason between field and campus personnel, and part-time help to assist with record keeping and routine activities of the Project.

Field Staff worked directly with some farmers and indirectly with others in order to compare two methods of technology transfer. Approximately 80 farmers were involved as official cooperators in the project. Many others received information but no data were maintained on their operations.

The major objective of the Project was to determine what would happen to farmers and communities over 10 years if existing technology was presented in a new approach. This objective originated from the question: "Is present technology not adopted by farmers because it is not meaningful to their situations or has it never been presented to them in a meaningful fashion?"

Due to time limitations, I will not dwell in great detail with our methodology. The following are some of the things done in our Project that are similar to those presented in the Farms Systems Research concept:

(1) Scientists were located in the community with people they were serving.

(2) Extension (technology transfer) and research (demonstrational and applied) were combined into a single functional unit.

(3) Individual farms were viewed as a total system and not a group of unrelated entities.

(4) Farmers had a role in determining research needs and participated in experiments conducted on their farms.

(5) A team or package approach was used.

Some things learned relative to organization and procedures that I think are applicable and needed in the Farming Systems Research concept are:

(1) Goals and procedures

(2) Competent staff

(3) Appropriate disciplines

(4) Community involvement

(5) Mutual confidence

(6) Adequate funds

(7) Administrative support

(8) Package approach

Some further conclusions based on our experiences are:

(1) Existing technology needs modification

(2) One-to-one contacts are most effective

(3) Changes occur slowly

(4) Continuity of staff is important

(5) Staff communications are essential

(6) Support staff can play a major role

(7) Office location is important for farmer initiated contacts

We have found the approach used in AHP to be very successful. Farmers benefitted from increased production and increased income per farm. Their attitudes became more positive and cooperation increased. The University benefitted from increased contacts with clientele which resulted in more meaningful research and teaching and better public relations within the State.

Evaluation of Farms Systems Research in Relation to the South Central Small Farm Research and Extension Center Program

J. R. Gifford[1/]

The Booneville Center will be a demonstration research facility principally serving small farmers of the interior highland (hill country) parts of 10 states (Oklahoma, Texas, Missouri, Arkansas, Tennessee, Kentucky, Louisiana, Mississippi, Alabama, and Georgia). Initially, on about 1500 acres, available for the Center, selected crop and livestock operations will be established, using lands representative of and other resources common to small farmers in the highland farming areas. We will attempt to demonstrate ways that resources commonly available to these small farmers on these hill lands can be combined with appropriate endeavors, management and cultural practices to produce efficient more appropriate and more economically viable combinations of technology or even enterprises that will, increase the productivity of and promote the livelihood of these smaller and often resource limited farmers.

Technological systems investigated at the Center will be based on applying new adaptable technologies and production systems gleaned from other federal, state or private locations, from existing successful small farm operations,

1/ Center Program Coordinator and Director, South Central Small Farm Research and Extension Center, USDA, SEA-AR Southern Region, Delta States Ares, temporarily located in "The Village #2", Hwy 10 East, P. O. Box 85, Booneville, AR 72927. Telephone (501) 675-3834.

from technologies already in existence and when deemed necessary or desirable build upon these by modification. Simple, easy-to-use packages of workable and promotable technologies will be devised and demonstrated at the Center.

Invariably, knowledge gaps and newly identified problems will arise from such a Center operation. Research at the Center will be problem-oriented with an interdisciplinary approach concentrated on the problems of small farmers who usually operate on a mixed-enterprise basis. Mixed enterprise may mean any number and combinations of on-farm or off-farm endeavors, through which the small farmer derives his livelihood.

Research at the Center will in one sense be "holistic". Holistic consideration is needed when addressing to any component of any total endeavor -- in this case successful total small farming operations. In reality, research condu-ted at the Center, least-wise in the initial phases, will not be "holistic" or "meshing" research will be problem oriented toward problems indentified and spoken to by small farmer research users. Enterprises at the Center will initially consist of forage/livestock, vegetables and small fruits. These initial research thrusts address to enterprises which have been most frequently spoken of as principal endeavors of small farmers or are believed by many to have greater potential for the hill area of the mid-south. Hopefully as the Center evolves personnel and funds will allow for a more holistic approach to small farms research -- more than just consideration indirectly of many other enterprises that are important components of small farm operations within this region. Meanwhile, at the off-set, the 4 thrusts areas previously stated will offer a challenging opportunity for the fou scientists (Animal Scientist, Agronomist, Horticulturist and Entomologist) presently assigned or now on board at the Center. Logistics of developing the 1500 acres of demonstration/validation experimental lands are in different stages of both planning and actual development. Hopefully, the 1981 growing season will find some "gap-filling" field experimentation underway for all initial thrusts of the Center.

Currently, while logistically putting together the Center, detailed research and extension programs with both short and long range goals of the Center are being worked on by the Core Staff in consultation with many small farmer research users, other researchers and extension specialists of the University/SEA/and private foundations, program planning administrators, other federal, state and county agencies and in some cases businessmen that understand to some extent the plight of small farmers, are sympathetic to their needs and can favorably impact success of the small farmers operations. This approach, through the use of AD HOC committees as well as other meetings, scheduled with the help and inputs of the state cooperative extension service and county agents is bringing forth what might be called "grass roots" or "users" inputs for the consideration and benefit of we in research, extension and education. Additionally, complimentary efforts are now underway to use intensive subject matter statistical surveys to characterize small farms of the "hill" region and determine their "real world" researchable needs and problems. The Center's "gap filling" research will address high priority needs or problems surfacing through all of these inputs. Thus, the Center will initially involve some of the same small farm people that are served by the Center's research and extension in planning the program of the Center.

Hopefully, as we progress in our Center program either in-house or extramural procedures will be devised to include the expressed felt needs of a greater number of small farmers throughout the 10 state area. Hopefully, we will be able to establish mechanisms that will allow these people to present and receive response to their problems from the Center in a timely manner. Identification of genuine technological needs and problems of the small farmer is a time consuming process. Technological needs of small farmers are in many cases location specific. Problems or needs of small farmers are continuously shifting. These problem shifts can result from biological or physical changes (such as diseases, pests, long term weather conditions, etc). Among other things they can result from sociological considerations including such things as consumer/market demand often resulting from "easy living/or hard" times. Whatever the cause, they will require constant reassessment and incorporation of new ideas into experimental design to meet and overcome enough of these problems to make a real and favorable impact toward helping the small farmer be more productive and become more on-farm self sufficient.

Only the research component of the Center is being realized initially and then only partially. Four, of what hopefully in time will be an interdisciplinary small farm research team of 9 scientists, are now assigned to the Center. Three of these scientists are SEA-AR employees and the fourth is on the Staff of the University of Arkansas supported through a SEA Cooperative Agreement. Pressures of existing organizational scientist evaluation systems, pressures to produce quick tangible results in order to justify the program of the Center by any fashion or form will require thorough considerations and determinations -- "in-truth" -- whether the Centers goals are principally to generate, validate, and demonstrate to the point of adoption technology that will help the small farmer become more productive and better off or whether our goals are principally directed toward satisfying requirements in order to document something on paper therefore survive to investigate and serve the actual research users another day. Hopefully, small farms researchers, extension specialists and educators will find the kind of support from Agricultural Research and Extension administrators that will develop alternate ways to help researchers and specialists withstand these pressures that are often only vaguely if at all productively oriented toward the end-product of materially helping the small farmer.

It has been projected that state cooperative extension specialists and perhaps federal extension will become part of the Center team within a couple of years after a Center research program is established. These specialists, an integral part of the Center team, will collect and disseminate information on small farms throughout the region to be served. They will serve as team liaison people to state and county staffs in the region, packaging educational material by modules for initiating or expanding work with small farmer clientele in a more timely manner. They will also be complimentary to the research staff of the Center toward greater interfacing of researcher's with user's needs and problems when planning the Center's research program and providing timely responses for these small farmer needs. With many questions yet unresolved where the Center may be headed fund-wise, personnel-wise, facilities-wise, and even program-wise, I would like to share these plans that are subject to change with you. Much of what is planned for the Center falls within a Farming System's research approach. (a) For instance, although team scientists have been disciplinarily trained and are generally commodity oriented they will be concentrating their efforts toward an interdisciplinary approach of small farm problems while taking into account and orienting the Center program toward the total small farming operation. (b) There will be a blend of both that referred to as "upstream" and "downstream" research. Research conducted on the Center will be directed toward solving some of the major problems of small farmers that are shared commonly throughout a given region by all or at least a homogenous group but only when answers to these problems are not available elsewhere. By the same token "location specific" problems may be addressed both on the Center or on farmer cooperators. Regardless, the planning of all research will have the inputs of small farmers and a considerable degree of the implementation and evaluation using farmers fields and resources will in time occur.

As the Center program is initiated conventional but "gap filling" research on the four thrust areas previously spoken to begins. This research will soon be advanced to sub-enterprise module experimentation on site. These modules can be evaluated individually or collectively for alternative enterprise compositing for total farming systems analysis. They will also serve the Center for demonstration and validation purposes. In time enterprise interaction studies will be conducted by physically developing small farm demonstration models on the Center. These small demonstration farms perhaps developed with the benefits of simulation modeling and total systems analysis will serve to demonstrate farming as limited by resources but when determined under controlled and monitorable management practices that often are not achievable through off-site on-farm cooperative studies. Additionally, experimentation will be conducted on small farm cooperators, using their resources and their initiative in planning, implementing and evaluating the experiments. These cooperative studies will serve as demonstrations for the extension of the Center. They will provide a two-way learning opportunity for researchers and small farmers each serving as teacher at times. They will improve user acceptance of the result of the research by having a ready-made show and tell within the user's communities.

APPLICABILITY OF THE FARMING SYSTEMS RESEARCH APPROACH TO LESS DEVELOPED AND DEVELOPED COUNTRIES - LINKAGES AND CONSTRAINTS

BY

MICHAEL S. JOSHUA
BUREAU OF ECONOMIC RESEARCH AND DEVELOPMENT
VIRGINIA STATE UNIVERSITY
PETERSBURG, VIRGINIA

SYMPOSIUM ON FARMING SYSTEMS RESEARCH
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ISSUES DISCUSSED

A. VIRGINIA STATE UNIVERSITY AND RURAL DEVELOPMENT

(1) Domestic (USA) Program

(2) International (Ghana) Program

B. FARMING SYSTEMS RESEARCH AND DOMESTIC-INTERNATIONAL LINKAGES

C. CONSTRAINTS ON THE FARMING SYSTEMS RESEARCH APPROACH

(1) Management of the Knowledge System

(2) Applicability of Farming Systems Research Approach

A. VIRGINIA STATE UNIVERSITY AND RURAL DEVELOPMENT

Virginia State University (VSU) through its Bureau of Economic Research and Development (BERD) conducts rural development research in seven areas: Manpower, Management, Production Analysis, Marketing, Agricultural Finance/Rural Financial Markets, Farming Systems, and Urban and Ecological Studies. Its approach is interdisciplinary utilizing the disciplines of Economics, Business Administration, Sociology, Statistics, Psychology, International Studies, Education and Agricultural Economics.

Aware of the unique perspective which the 1890 land grant institutions can bring to the study of rural development problems, BERD has articulated a program of domestic and international research aimed at solving rural development problems. This program gives evidence to those involved in rural development decision-making of the expertise available at VSU.

(1) Domestic focus

Research is carried out in a 16 county (and 5 city) area of South Central Virginia which BERD has defined as its study area for domestic rural development. These 16 counties include: Amelia, Brunswick, Charlotte, Cumberland, Dinwiddie, Greensville, Halifax, Isle of Wight, Lunenburg, Mecklenburg, Nottoway, Pittsylvania, Prince Edward, Southampton, Surry and Sussex. The five cities of Danville, Emporia, Franklin, South Boston and, Suffolk are included.

The research activities (completed and ongoing) in South Central Virginia have been organized into parts of a rural sector study focusing on the socioeconomic aspects of the low income small farm and non-farm units. An illustrative cross section of the research projects include:

(1) MARKETING STUDIES

(a) Market Organization and Activities by County in South Central Virginia

(b) The Small Farmer and Agricultural Marketing in South Central Virginia

(c) Market Structure of Selected Agricultural Products and Services Industries in South Central Virginia

(2) AGRICULTURAL CREDIT AND RURAL FINANCIAL INSTITUTIONS

(a) An Analysis of Commercial Bank Credit to Farmers in Pittsylvania County, Virginia

(b) Demand for Agricultural Credit

(c) Credit to Small Farmers in Selected Counties of South Central Virginia

(3) PRODUCTION STUDIES

(a) Economic Analysis of Small Farm Production in Swine Operations of South Central Virginia

(b) The Effects of Socioeconomic Characteristics Adoption of Recommended Beef Farm Practices

(4) RURAL DEVELOPMENT STUDIES

(a) Agricultural Resources and the Development of the Small Farmer in South Central Virginia

(b) Sociological and Economic Factors Affecting the Labor Supply and Earnings of Male and Female Heads of Households in South Central Virginia

(c) A Comparative Socioeconomic Profile of South Central Virginia

(d) Socioeconomic Impact of Intrastate Motor Carrier Regulations on Rural Development

(e) Occupational Mobility of Rural Labor

(f) Labor Turnover in Small Enterprises in South Central Virginia

(5) WOMEN AND RURAL DEVELOPMENT

(a) Social and Economic Characteristics of Women in Virginia-the Labor Status of Rural Women

(b) The Value of Farm-Wives' Time in Agricultural Production in South Central Virginia

(6) HUMAN RESOURCES AND RURAL DEVELOPMENT

(a) An Assessment of Human Resources in South Central Virginia

(b) Human Resources in South Central Virginia - Social and Economic Characteristics

Research projects conducted in the South Central Virginia laboratory area develop and utilize research methodologies that are transferable to LDCs. One critical methodological area relates to the unit and framework of analysis. VSU's experience in studying constraints on rural development points to the need to focus on the farm-firm-household (FFH) as the unit of analysis. The interaction between consumption and production activities play an important role in resource allocation decision making in the rural sector. This means that the appropriate model is the FFH. Further, since the the performance of the FFH is affected by forces external to it (marketing facilities, input delivery systems, extension, agricultural knowledge systems, and value system) the most appropriate framework for analysis is the systems approach. This approach permits an examinatation of the internal and external factors affecting consumption/production activities and so permits better targeting of constraints and more accurate and effective intervention strategies.

Another critical methodological area relates to information mobilization strategies. Focusing on a rural area in the U. S. which has little secondary data available for assessing its basic socioeconomic constraints and needs is analogous to the conditions prevailing in some LDCs. Experience in determining factors affecting socioeconomic conditions in this country's rural areas provides the researcher with important insights into the problems of limited resource rural people in developing countries. Methodology has focused on household and farm survey techniques and extensive interviews, as well as careful quantitative and non-quantitative analysis of data. Since primary data collection expertise is essential for socioeconomic research in developing countries, the field experience and the research methodologies developed in the laboratory area encourage the attainment of the skills needed to gather information in developing countries.

(2) International focus

VSU, utilizing its experience in field work and the development of methodology for resolving socioeconomic problems in rural South Central Virginia, developed an international program with similar focus for implementing in LDCs.

The program was initiated with a bilateral linkage agreement with the University of Science and Technology (UST) in Kumasi, Ghana. This UST/VSU linkage program has enabled staff members at VSU to increase significantly their capability to identify, design, analyze and evaluate rural development projects in LDCs.[1]

Research carried out under the UST/VSU linkage program includes:

(1) CAPITAL, CREDIT AND RURAL FINANCIAL INSTITUTIONS

(a) Enterprise Combination and Capital Requirements in Northern Ghanaian Agriculture: Case Study of the Kumbungu Area

(b) An Evaluation of Institutional Credit and its Role in Production in Ghana

(c) The Role of Credit in the Adoption of New Technology. Case Study of Small Rice Farmers in Northern Ghana

(2) LAND TENURE AND AGRICULTURAL PRODUCTION

(a) Customary Land Practices in Relation to Agricultural Production

(b) Land Tenure Systems in Relation to Agricultural Production

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[1] The program afforded VSU staff to spend approximately five person years in Ghana (at UST) in research, teaching and the organization of conferences. UST staff spent approximately two person years at VSU on similar activities.

(3) APPROPRIATE TECHNOLOGY

(a) Production of Agricultural Implements for Small-Scale Rice Farmers: Socio-Economic Aspects

(4) SMALL FARMERS AND RURAL DEVELOPMENT

(a) Supply Response of Cotton Farmers in Northern Ghana

(b) Economic Viability of Small Scale Farmers in the Forest Zone of Ashanti

(c) The Economics of Small Farm Systems and Socioeconomic Conditions in the Atebubu District - Ghana

(d) Marketing and Infrastructure-Food Marketing, Transportation, and Small Farm Production in Ghana- A Case Study of the Atebubu District.

For the most part the above research projects cover a range of issues that reflect an attempt to understand the farm, farmer and the farm environment as a complex system of interdependent parts. Secondly, they reflect an attempt to determine the intervention strategy by delineating the constraints posed by the internal and external farming environment. And thirdly, they reflect an attempt to utilize an interdisciplinary/multidisciplinary framework of analysis.[1]

B. FARMING SYSTEM RESEARCH AND DOMESTIC - INTERNATIONAL LINKAGES

While VSU might not be following the letter of FSR approach, its rural development strategy does reflect the spirit of FSR. It is farmer focused; it is interdisciplinary and it is systems approach oriented. Further, the target group studied- small limited resources farmers- is the same in both Virginia and West Africa (Ghana). The structure and capacity for growth differ only in degree and not in kind. Our research in South Central Virginia indicates that the limited resource farmers

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[1] D. Rohrbach, (9).

(1) are shifting from farm to non-farm activities (off-farm employment), (2) Do not necessarily belong to a homogeneous group, (3) are under-utilizing land resources because of a lack of appropriate equipment and a lack of access to capital, (4) can, with given resources, increase their net income through better planning and better utilization of available resources,[1] (5) have limited access to appropriate technology, (6) interact with support systems (marketing facilities, transportation, agricultural knowledge system) that can be improved. As a result, they make less than optimal contribution to socioeconomic development. With respect to the limited resource farm families in Ghana all of the above problems affect their operations albeit to a greater degree. The important point here is that the nature of the problem, being the same, there seems to exist real opportunities to develop lessons of experience that serve both rural American and rural Ghana. In short, there are links that can be forged between these two environments as regards rural development problems and solutions. The linkages are not so much concerned with technological practices only a relatively small part of which can be transferred any way, but more with the management and administration of agricultural and rural change, including production, output and input systems and the associated questions of prices, capital, and credit; articulation of official services with one another and with services provided by the private sector; groupings of producers; and management at the subdistrict level, rural level, where the real producers are. Developed countries have evolved

[1]See Sammly L. Comer and R. C. Woodworth, Improving Incomes on Limited Resource Farms in South Central Tennessee, Tennessee State University. Nashville, Gennessee Bulletin #36 Oct. 1976.

Quanda L. Cooper- An Economic Analysis of Small Farm Production in Swine Operations of South Central Virginia MA thesis, Virginia State University, Petersburg, VA 23803.

mechanisms for dealing with the whole process of managing rural development. LDCs can adapt these mechanisms to their particular locale avoiding the inconsistences that accompained their evolution. Plans for increasing incomes of limited resources farmers in Virginia and Ghana deal with a very complex undertaking. The complexity is not due to a technology problem in the narrow sense, but to the administration and management of rural development, because whether incomes can be increased will depend on the extent to which the appropriate administrative mechanisms can be developed to manage the cooperation among researchers/research institutions, extension services, the delivery system of support systems and the limited resources farm family.

BERD/VSU has recently established a Small Farm Development Center, whose major task will be the development and testing of a small farm model that can be used as a framework to mobilize the potentials of limited resource farm families and enhance their productive capacity. Given the similarity of the nature of the management problems in rural sectors of Virginia and Ghana, it is expected that such a model with appropriate modifications could be used effectively in less developed countries (LDCs)- Ghana.

C. CONSTRAINTS ON THE FARMING SYSTEMS RESEARCH APPROACH

Among the many major institutional, technical and managerial constraints that affect the implementation of the FSR appraoch the severest, as far as limited resource small farmers are concerned, are those generated by the external environment. Of particular importance is the agricultural knowledge system (AKS) and its management.

The ideal AKS consists of:

(1) Human capital (existing stock of knowledge)

(2) Means of expanding the stock of knowledge-research

(3) The means of preparing accumulated knowledge for use on a practical level - development

(4) The practical means of applying the knowledge or technology to particular purposes- extension subsystem

(5) Education and training subsystem

(6) Farmers and farmers' organization

An effectively managed national AKS must

(1) Coordinate all of the following structures/functions:

(a) Information subsystem

(b) Education subsystem (primary, secondary, tertiary)

(c) Research institutions

(d) Extension services

(e) Education and training of rural people

(f) Farmers and farmer's organizations

(2) Produce trained personnel at all levels including technicians, and in all relevant subject areas

(3) Provide the stability for monitoring and evaluation

(4) Provide for field service- extension services- to be a part of the system as an essential partner in helping to study the existing system and the multiple purposes and real difficulties of producers, to help select objectives for research and to monitor changes

(5) Involve producers especially small farmers

Experience in Ghana indicates that the components of the knowledge system (the necessary conditions) are for the most part in place; however, their coordination (sufficient condition) is either non-existent or mal-function. Despite the existence of universities with agricultural faculties, a structure of research institutes covering major areas of agriculture, agricultural training programs and an extension service,[1] national coordination is weak and there is significant inbalance in emphasis on the technical as opposed to the social science aspect, too little emphasis on the development of appropriate technology, and inadequate linkages between national researchers and national research users. It is possible to perceive a real linkage between the South Central Virginia and Ghana in the sense that in both areas the nature of the small farm problems is basically the same: the small farm sector is a relatively neglected sector, 'technology' needs are urgent, comprehensive information on the small farm problem is non-existent, although from a technical standpoint, some of the modern technology is scale neutral, operationally, small farmers are unable to adopt because of the effectiveness of the constraints imposed by the knowledge system as reflected in the form of inefficient dissemination of technology and for inadequate extension services and system.

(2) Further Constraints: Applicability of FSR Appraoch.

The constraint on FSR by the management of the knowledge system of LDCs can be traced to the evolution of the system. In many LDCs agricultural research developed in the preindependence period much earlier than agricultural education at the primary, secondary and tertiary levels. Moreover, such research as developed was concerned with development of export crops from the plantation sector, each of which had its own research institution. Research was done by expatiates for the technical staff of the plantation. Extension services were needed only where cash crops were grown by small-scale producers (Cocoa-Ghana). The legacy of this development is that in many LDCs the academic components of the know-

[1]Two major universities with schools of Agriculture and one concerned with the training of agricultural (vocational) teachers; under the Council for Scientific and Industrial Research (CSIR), of the nine research instituues, five are concerned with agriculture related research- soil, crops, food, forest products, livestick, etc. Four institions for training extension workers- See Barron and Mensah (1), National Extension Services.

ledge system is neither organizationally or operationally linked to the research component. Where this is the case, there is a tendency for separation between agricultural research and the human sciences. This operational style puts severe constraints on attempts to develop multidisciplinary understanding and cooperation needed to describe, analyze and improve the existing resource- use systems. More importantly it constrains the academic institutions' ability to associate with ongoing efforts of the government in agricultural research or in agriculture and rural development. Even where attempts have been made for closer linkages, it has not been easy to build strong associations between the universities which are either autonomous or associated with the ministry of Education. Knowledge systems which reflect such weak linkages fail to provide the professional personnel throughout the system with the professional growth that is expected to occur within the system.

It seems useful to distinguish between knowledge systems with weak coordination and those with strong coordination. The former will be referred as centrifugal systems reflecting a lack of consensus among the disparate groups composing the system, and the latter centripetal system reflect the existence of such consensus. It makes quite a difference to the applicability of FSR if one or the other system is dominant in a given country. In countries where the centrifugal system predominates (Ghana) FSR practioners will have to consider using an interventionist, as opposed to the submissive approach.

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Research-Extension Interface

ABSTRACT

Howard W. Kerr, Jr.

U.S. Department of Agriculture[1]

To prepare for the Farming Systems Research symposium, I read the paper of Robert Chambers, University of Sussex, entitled "Understanding Professionals: Small Farms and Scientists". Of particular interest was Mr. Chamber's statement -- "The challenge is to listen to and learn from farmers, encouraging them to express their categories, meanings, and priorities, and treating them not just as professional colleagues and collaborators, but as teachers." Viewing farmers as teachers is an approach, I believe, that is relevant to domestic small farms research and specifically to the Northeastern Region (NER) small farms research program. To appreciate this idea, one must first understand the framework within which the NER small farms research program operates.

Agricultural Research is one of the three major subunits that comprise the Science and Education Administration (SEA). Cooperative Research and the Extension Service complete the structure of SEA. Each agency has specific responsibilities and, in the most general terms, Cooperative Research and Agricultural Research are, respectively, the State and Federal research arms while Extension Service is the educator and disseminator of information. Prior to the formation of SEA, these agencies had all functioned as independent agencies within the Department. United under SEA, they were consolidated to form the Department's science (research) and education (dissemination) thrusts.

Small farms research efforts began in FY 1979. In February 1979, the NER Administrator named a coordinator for the program, charging him to "make the approximate $1.5 million small farms research funds accountable, tractable, visible, and yield tangible results." Seventy-five percent of these funds were designated for in-house research and 25 percent for extramural research to be conducted by State Agricultural Experiment Stations and institutions located in the Northeastern Region. The target areas of research were selected and identified by the SEA National Program Staff small farms committee.

Quickly, it became evident that a plan was needed to identify specific research needs of small-scale farm operators so that limited AR small farm funds could better be targeted to developing appropriate technologies. To develop a plan, a survey questionnaire was sent to Extension Service county agents, requesting information relative to small-scale agriculture in the Northeast. A definition of small farms operations was provided. Questions were limited to 2 pages and were designed to provide a profile of small-scale agriculture in that county, particularly the immediate research needs, specific directions for future research, and technology needed in 1984. The questionnaire also asked how small farm operators would be affected in the next 5 years, as the economy rapidly changed due to energy shortages, tight money, and expected higher food costs.

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[1] Coordinator, Small Farms Research, Northeastern Region, Science and Education Administration, U.S. Department of Agriculture, Beltsville Agricultural Research Center, Beltsville, Md. 20705. Paper presented at the Symposium on Farming Systems Research on December 8, 1980, Jefferson Auditorium, USDA, Washington, D.C.

SEA's Agricultural Research (AR) is a storehouse of knowledge, however, most of the NER scientists are located in centers such as the Beltsville Agricultural Research Center or Eastern Regional Research Center. These citadels tend to restrict the scientists' exposure to the full breadth of real world problems, particularly those of small-scale farms. Further, because the scientists are experts in a particular agricultural science, their interest and expertise will necessarily be focused on the scientific discipline in which they are academically trained. Thus, AR scientists were not the best respondents to the questionnaire.

On the other hand, Extension Service (ES) county agents are deployed in every county of the United States, where they can better understand and further educate the agricultural sector. This ubiquitous force of county agents have daily contact with the farming community. Thus, a selected group of 70 ES county agents in the NER were identified to respond to the mailed questionnaire. An analysis of their responses[2/] provided the major thrust for a relevant small farms research plan.

The hallmark of the NER small farms research program is the communication between AR and ES. This approach focuses on rectifying small-scale farm operators' needs by targeting the limited resources of each agency to yield maximum returns. ES has grass root contacts with small farmers and thus can best identify the needs of small farmers. This information is needed by AR scientists when deciding the appropriate technology to develop within the constraints of what is feasible considering the current capabilities of science-at-large for small farms. AR scientists will publish their findings or results; however, to more quickly reach small farmers, the new knowledge should be presented in a SEA AR/ES communication. Disseminating information to the small-scale farm operator, remains the responsibility and work function of ES. With proper communication between research and extension, each can perform its role in a team effort. The team is perhaps more like a track team than a football team but, nevertheless, each can take complete pride in their achievements.

[2/] Kerr, Howard W. 1980. A Survey of Current and Expected Research Needs of Small Farms in the Northeastern Region. ARR-NE-9, USDA/SEA, Beltsville, Md 20705

December 4, 1980.

INITIATING APPLIED FARMING SYSTEMS RESEARCH IN DEVELOPING COUNTRIES*

L.W. Harrington**

1.0 Introduction

Farming systems research (FSR), in its various manifestations, is receiving increased attention as a means to stimulate agricultural development. During the last several years, donors, international agricultural research centers (IARC's) and a number of national research programs have developed alternative methods for conducting FSR. There has recently been a substantial effort on the part of these "practitioners" to pool their knowledge and share their experiences. The result has been a remarkable degree of consensus on procedures for FSR, at least when the scope and purpose of research are carefully specified, e.g., applied FSR conducted by national programs versus basic FSR conducted by IARC's (Harrington, 1980).

Although research on FSR procedures continues, a related issue is gaining prominence: implementation of applied FSR in national research programs. The issue is clearly one of feasibility. How feasible are FSR procedures for national programs, given the various constraints under which they operate? What are the basic decisions that must be taken to initiate FSR? What steps are necessary to make FSR operational? The purpose of the present paper is to address some of these questions.

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* Paper presented at the AID-USDA Symposium on Farming Systems Research, Washington, D.C., 8-9 December, 1980.

** Economist at CIMMYT, Mexico. The opinions expressed are not necessarily those of CIMMYT.

In order to comment on the feasibility of implementing applied FSR in national programs, however, a characterization of FSR is needed. Applied FSR is viewed as research that is:

1) problem-oriented -- research focuses on the solution to production problems that promise to have a considerable effect on farmer goals (e.g., increased income at reasonable levels of risk).

2) on-farm -- experimentation is planned and conducted in light of farmer circumstances and under farmers' conditions.

3) multi-disciplinary -- the effective collaboration between biological and social scientists is needed in the design and testing of new technology.

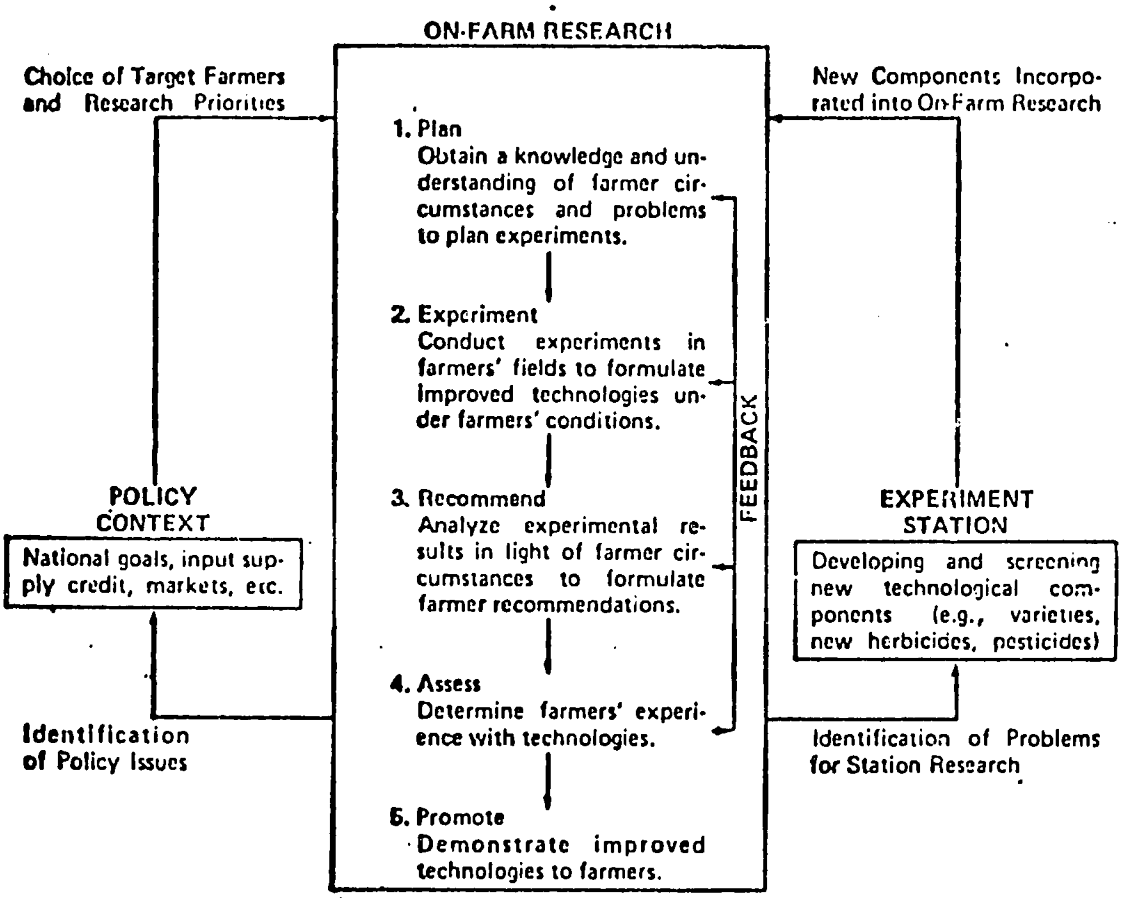
The approach to applied FSR used at CIMMYT may be seen in Figure 1. On-farm experiments are planned in light of farmer problems and circumstances. Experimental results are analyzed in order to formulate recommendations. Those recommendations are subjected to farmer assessment before being promoted among target farmers (Byerlee, Collinson et al, 1980).

The very characteristics of applied FSR (farmer-oriented, on-farm, multi-disciplinary), of course, lead to many of the issues and difficulties in implementation that will be discussed in subsequent sections.

2.0 National Research Programs: Constraints and Circumstances

There exists a great diversity among developing countries with regard to the structure and operation of their agricultural research programs. Nonetheless, the majority of national programs share at least two salient characteristics: (1) an institutional environment that is not entirely sympathetic to the introduction of FSR, (2) a scarcity of research resources.

Figure 1. Overview of an Integrated Research Program



The institutional environment often constitutes a major obstable for the initiation of FSR. The agricultural research system itself, usually organized along disciplinary or commodity lines, often resists the introduction of FSR because of the consequent need to re-define institutional jurisdiction. Individual researchers, having been trained as disciplinarians, frequently see FSR as a threat to traditional research activities. Even researchers who see a need for FSR have little incentive to push for its introduction. The current structure of incentives (salary increases, promotions, peer approval) normally favors those who excel as disciplinarians.

Other institutions, outside of the established agricultural research system, may also prove to be obstacles. On-going rural development programs may frown on the introduction of FSR into their areas of influence, foreseeing that FSR may discredit some of their past efforts. Even extension services may see FSR as an usurpation of their traditional prerogative of linking with farmers.

Institutional difficulties are made more acute by financial constraints. FSR can be expected to produce superior results when the research teams are composed of highly-skilled personnel who control a budget adequate for survey and experimental field work. Mobility is especially important: researchers must be able to visit experiments and farmer-collaborators frequently.

Skilled personnel and funds for recurrent expenses are, however, especially scarce in LDC agricultural research programs. In many countries there are few social scientists available for work on FSR. There are even fewer (and in many cases, none) who have either training or experience in collaborating with agronomists in problem-solving research. Similarly, resource limitations can strongly affect the conduct of FSR. In Ghana, fuel for staff vehicles was extremely scarce during the initiation of an FSR project. Researchers had to use

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considerable ingenuity to obtain a modest fuel allowance for on-site visits. In the face of resource limitations, then, the demands of an FSR program must either be met by diverting resources from on-going research activities or by obtaining special-project funding.

Researchers engaged in traditional, on-station research can point, in defense of their budgets, to recent studies indicating a high rate of return to their past activities (e.g., Arndt et al, 1977). However this may be, FSR practitioners believe that their approach is far more cost-effective in terms of "technology adopted per monetary unit spent" and that FSR deserves a chance in most national programs.

3.0 Initiating Applied FSR

A decision by a national agricultural research program (or by individual researchers in such a program) to "give FSR a chance" leads directly to other decisions on organization. These decisions focus on the institutional character of FSR, the proper scope of research and the choice of target area for the initial FSR enterprise. As the organization of FSR takes shape (at least for initial efforts), increased attention may be paid to operational questions, such as training researchers in FSR procedures, insuring effective multi-disciplinarity and getting research onto farmers' fields.

3.1 Institutional Character of FSR

An important decision that must be addressed early is that of "program versus project". As described in the CID Draft Guidelines (Consortium for International Development, 1980), the "program versus project" choice is one of scale. Initiating FSR as a project merely entails the assignment of a team of researchers to conduct FSR in a given target area. It is not necessary that the supporting agency make any large changes in research philosophy or organization. The project approach to FSR can be especially painless (in a budgetary sense) because special-project funding may be available for initial FSR efforts.

The program approach is more ambitious, requiring a major commitment to FSR from the beginning. An FSR program may be carried out through the re-orientation and co-ordination of the activities of existing agencies or through the creation of a new agency with a mandate for FSR.

The decision made on the "program versus project" issue will depend on the specific circumstances of the case. However, the project approach to FSR is more attractive under conditions of institutional neutrality or hostility, and scarcity of research resources. Given that these are the very conditions that most national programs must face, the project approach to FSR has proven to be relatively popular. Within national programs, it is possible to "start small", without major institutional rearrangements.

3.2 Scope of Research

Whatever the scale of FSR organization that may be adopted, another issue must immediately be faced: the appropriate scope of research. It is patently impossible to consider everything as variable at the commencement of research: some things must assumed as fixed, outside the scope of research. The phrase "farming systems research" carries with it a connotation of wholeness, a feeling that all management practices in the farming system must be considered as variable. However, there is no reason why some of these management practices may be not also be classed as fixed. The issue, then, is how many practices should be allowed to vary during research -- many or few?

One alternative is to allow many variables, considering for example the selection of crop or livestock enterprises for a farming system (and the management of each) as variable. This has been called "FSR-in-the-large". Another alternative is to focus research on the management of one (or few) enterprises in the context of the current farming system. This has been called "FSR-in-the-small". The point of importance is that this focus on one or few enterprises is still a valid form of FSR. This is because the design and analysis of research on these few, selected enterprises takes into account effects of technological change on other components of the farming system.

A focus on one (or few) enterprises in FSR is likely to be particularly wise under the following conditions:

(1) The bulk of farmers' resources are used in one enterprise (e.g., maize in much of Central America, wheat in N. Africa) so research on this enterprise is likely to have the best leverage on such system problems as deficient income, excessive risk, or seasonal variability in the employment of farmer-owned resources (Collinson, 1980).

(2) There appears to be some scope for improvement in the management of the pre-dominant enterprise. In fact, our experience indicates that, in the case of maize or wheat, improvements in crop management can have substantial impacts on production and farmer income.

(3) Land-use is not highly intensive (although even here a single enterprise focus will often lead to useful innovations as long as system interactions are carefully considered).

A focus on the most important enterprise(s) will, in addition, normally lead to lower research costs. The amount of information on farmer practices and circumstances needed to plan research (describe representative practices, identify priority production problems, pre-screen potential solutions to these problems) is less when research is well-focused. Similarly less data is needed for evaluation of experimental results. Even farmer assessment of new technology is facilitated because recommended improvements on the current farmer practice tend to be relatively uncomplicated, making it easier for farmers themselves to evaluate these improvements.

Needless to say, the specific choice of target enterprise(s) will vary from target area to target area. The issue to which reference is being made is one of scope: in general, should researchers try to improve the management of one (or few) major enterprises in a farming system or should they attempt a broad-brush re-design of that system? National research programs interested in FSR should consider a relatively simple and inexpensive form of FSR -- that of "FSR-in-the-small".

3.3 Choice of Target Area

Another major decision in the initiation of FSR concerns the target area, or region where initial research efforts are to be carried out. While it is conceivable that an FSR program may wish to initiate research in many areas simultaneously, FSR is usually initiated in one or few target areas, both because of resource limitations and to allow researchers to gather experience in FSR procedures. The characteristics of the initial target area, however, may influence the success of the FSR activities therein and, consequently, can affect the probability that FSR will be extended to other regions, as well as the form it may take.

Several criteria may be considered in the selection of an initial target area: (1) The possibility of gaining tangible results in a reasonable period of time. This is particularly important when the credibility of FSR is at stake.

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Later, more difficult areas can be selected -- when greater researcher experience can help compensate for more difficult research problems. (2) The presence or absence of major bottlenecks (human resources, logistics) to the implementation of FSR. At least initially, accessible areas are preferred. (3) The likely effect of a success in FSR on such national objectives as lower food prices for urban consumers, rural development, income distribution, etc. For example, when food prices are of primary concern, a different target area may be chosen than when the welfare of small farmers is given top priority (Byerlee, Collinson, et al, 1980).

3.4 The Incorporation of Social Scientists in FSR

A key step in the initiation of FSR is the formation of research teams with effective collaboration between biological and social scientists. The role of the social scientist in FSR is now widely regarded as essential. The social scientist is responsible for incorporating the "human element", or socio-economic problems and circumstances that affect farmers' decisions, into the design and evaluation of new agricultural technology. He must take as much responsibility as breeders or agronomists for such research activities as choice of representative farmer-collaborators, selection of high-priority experimental variables, selection of the level of non-experimental variables, and evaluation of experimental results.

Effective multi-disciplinary is not, however, easy to achieve. An effective multi-disciplinary research team is composed of researchers who enjoy a sound base in their respective disciplines but who nonetheless work to meet a common objective: the development of new technology useful to farmers. That is, they must be "task-oriented". Collaboration is facilitated when one disciplinarian is aware of the questions that fruitfully may be asked of another (Bartlett and Akorhe, 1980).

Team effectiveness can be influenced by experience (or its surrogate, training) and team organization. The more experience researchers have in multi-disciplinary, problem-solving research, the easier subsequent collaboration becomes. In the initial stages of FSR, however, such experience is in short supply. Training team members in FSR philosophy and methods can help overcome this initial hurdle. Although some IARC's have begun FSR-related training programs, there is still a scarcity of such programs that focus on the practical, multi-disciplinary aspects of FSR. (See Gilbert et al, 1980, Chapter 7 and CIMMYT, 1978).

Team organization can influence the quality of multi-disciplinary collaboration by pre-determining both the role and status of social scientists. In one country, economists of a junior level were recruited to work as staff members on experiment stations, in order to encourage and collaborate in research on farmers' fields. Their relatively low status in comparison with their agronomist colleagues, however, proved to be a serious obstacle to their attempts to initiate FSR off-station. In another country, social scientists were involved in the planning and evaluation of on-farm research -- but as a "support unit", not as full-fledged members of a target area research team. Although useful information on new technology was produced, the absence of social scientists during the experimentation stage led to inadequate contact with farmers during that stage, with a considerable loss of farmer feedback on the characteristics of new technology.

In yet another case, agronomists and economists were organized as a target-area-specific research team, with joint responsibility for research decisions. This is normally regarded as the best form of team organization. Nonetheless, effective multi-disciplinary collaboration proved to be elusive because the relatively inexperienced economists demonstrated a preference for independent projects. While formally sharing responsibility for team decisions, in practice they preferred to work alone in conducting extended farm surveys that were only marginally related to on-farm experimentation.

In summary, a trained, experienced and task-oriented team of biological and social scientists, with joint responsibility for research decisions in a given target area appears ideal. Frequently, however, national program circumstances and policies will not allow the use of this ideal. In extreme cases, agronomists may be specially trained to provide a social science input. When a few social scientists are available, they may be either attached to experiment stations or placed into a "support unit" to back-up several research field teams. In these cases, however, the social scientist will usually be forced to cope with status problems and with an increased difficulty in acquiring an intimate acquaintance with farmer circumstances for a given target area.

3.5 Moving Research Onto Farmers' Fields - Farmer Collaboration

With few exceptions, research whose purpose is to provide useful new technology to farmers within a reasonable period of time must be conducted on-farm. This is because experiment station circumstances (e.g., soil fertility, weed and insect population, irrigation and drainage) are normally unlike those faced by target farmers.

Within a target area, then, the primary responsibility of the selected multi-disciplinary research team is to plan, conduct and analyze on-farm experiments. Armed with a knowledge of farmer problems and circumstances, researchers are in a good position to field-test promising solutions to important production problems. However, the team must avoid the temptation to conduct "experiment-station research" on farmers' fields -- i.e., in isolation from farmers.

On-farm research begins with a review of secondary data on the target area and surveys of target farmers, to ascertain their agro-climatic and socio-economic circumstances. This information can be used in a variety of ways in planning on-farm experimentation: farmers may be pooled into roughly homogeneous groups, or recommendation domains. For each domain, important production problems can be identified and possible solutions to these problems pre-screened for compatibility with the current farming system and for effect on farmer welfare.

A wide variety of experiments can be used in on-farm experimentation. Complete factorials (and in some cases "super-imposed trials") aid in identifying production limiting factors. Economic levels of inputs and practices that affect production can be estimated through researcher-managed, replicated experiments. Large-plot, unreplicated trials can verify the attractiveness of an innovation when compared to the current farmer practice (Palmer et al, 1980). Finally, farmer-managed trials allow farmers themselves to assess the attractiveness of new technology.

The key to effective on-farm research, however, is the maintenance of close contact with farmers. During the initiation of FSR, research teams often lose sight of this point.

During on-farm research, farmers should collaborate in various ways: respond to surveys, loan their fields, provide a reference point from which the effects of innovations may be measured (farmers' practice), comment on alternative experimental treatments, completely manage fields in which promising innovations are added to their current practice, and provide feedback on the reasons for liking or disliking proposed new technology.

Clearly, on-farm research without effective farmer collaboration can easily degenerate into a series of sterile exercises. Continuous contact with farmers is usually needed to maintain the "farmer-orientation" that characterizes applied FSR.

4.0 Low-Cost FSR

The feasibility of FSR for national research programs is a question that is currently attracting considerable attention. This question frequently takes the form of the cost-effectiveness of FSR, given its apparent expense. Some ways in which resource-poor research programs can initiate FSR activities have already been presented: (1) FSR can be initiated as a small-scale project instead of a large-scale program, (2) FSR can focus on important issues in the management of major crops (in the context of the farming system) instead of attempting the wholesale re-design of that system, (3) FSR can be initiated in an accessible target area in which prospects for success within a reasonable period of time are high, (4) FSR researchers can practice effective multi-disciplinary collaboration and close collaboration with farmers.

FSR practitioners claim that their approach is more "cost-effective" than traditional research in terms of "technology adopted per unit of money spent". They believe that traditional, on-station research in developing countries has led to relatively little adoption of new technology by small farmers. Nonetheless there is still a current of concern about the expense of FSR. It may be a worthy exercise, then, to list more ways in which FSR expense can be reduced.

A principal way to increase the effectiveness and reduce the cost of FSR is to stratify the farmers within a target region into relatively homogeneous target groups or "recommendation domains". A recommendation domain is merely a group of farmers facing similar problems and circumstances, operating similar farming systems, and for whom similar recommendations will be appropriate (Byerlee, Collinson et al, 1980). By placing all on-farm research in this context, one avoids the two extremes that serve as alternatives: (1) assume that research results will be appropriate for all farmers in a target area, heterogeneity in circumstances notwithstanding, (2) formulate separate recommendations for individual farmers.

The acquisition of data on farmer problems and circumstances provides another area of possible cost reduction. Informal, non-probabilistic surveys and well-focused, single-visit small-sample formal surveys are preferable to large-sample surveys or frequent visit surveys in this connection. The criterion for the selection of survey instrument should be that of "the lowest cost commensurate with the degree of understanding that is necessary." (Norman, 1980).

Another area of possible cost reduction is that of expanding the universe for which FSR results are applicable. This may be performed by determining the transferability of one set of results to other similar environments (i.e., extrapolating recommendation domains into new target areas). In this fashion, some (but rarely all) of the steps in FSR may be skipped.

Finally, it should be pointed out that it is unnecessary for FSR to produce the "best" new technology for farmers. Insofar as it discovers anything "better" than the current farmer practice, it will be useful. That is, FSR need not engage in the fine tuning of the farming system, but rather may concentrate on seeking the best of readily available solutions to important problems.

5.0 Conclusions

FSR procedures have been seen as fairly adaptable to the varying circumstances of national research programs. As a consequence, national programs wishing to commence FSR are faced with serious decisions. Among these are the questions addressed in this paper:

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- Should FSR be initiated as a large-scale program or a small-scale project?

- Should FSR focus on the management of major existing enterprises in the context of the current farming system or should it attempt large changes in that system?

- What are the desirable characteristics of a target area for the initiation of FSR?

- To what extent should effective multi-disciplinary collaboration be a priority objective? How can it be achieved? How should training be organized to prepare field team researchers?

- To what extent should FSR be conducted on-farm? How, and to what extent, should farmers collaborate in FSR?

- How may FSR be made more cost-effective?

No single methodology for FSR can be defined for use by all national research programs. However, even resource-poor national programs operating in an institutional environment not wholly sympathetic to FSR can and must afford to "give FSR a chance".

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Problems of Interdisciplinarity in Farming Systems Research*

Randolph Barker**

Scientists argue about the definition and meaning of "farming systems." However, there is general agreement that farming systems research requires a wholistic approach and this in turn implies a team or interdisciplinary research effort. In this paper I propose first to define the problems associated with interdisciplinary research in farming systems. Then I will discuss the implications for training. However, before discussing the problems, I would like to characterize the various forms of interdisciplinary research.

In the early part of this century there was little if any formal interdisciplinary research. However, the research staffs of the college of agriculture were small. As a result there was a good deal of informal interaction among disciplines, just as there is today in the international agricultural research centers. Under this environment each individuals' disciplinary research is likely to reflect to an important degree the influence of other disciplines.

As the disciplines grew, however, communication among disciplines in the agricultural colleges declined until today it is not uncommon for scientists to work and socialize exclusively with people in their own discipline. Formal interdisciplinary research studies in agriculture began in the 1940s. The earlist that I am aware of is the research by Jensen et al. (1942) on input-output relationships in milk. In the 1950s and 60s there was a great deal of

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**Professor of Agricultural Economics, Cornell University.

interdisciplinary research of this type conducted between agricultural economists and biological scientists particularly at Iowa State and Michigan State Universities (see for example, Hoffnar and Johnson, 1966). The degree of formal collaboration among researchers varied considerably from project to project. In some cases individuals workad together under a broad mandate that allowed each to pursue his/her own interests. In other cases a tightly managed group worked under a project director meeting frequently to discuss the design and execution of the research and integrating the results into a coordinated product.

Today it is still more common to find multidisciplinary projects loosely organized in such a way to enable each individual scientist to do his/her own thing. An obvious reason for this is the difficulty of conducting truly integrated interdisciplinary research. The obstacles encountered in undertaking such research are described below.

Defining the Obstacles

There are three elements in farming systems research which when analyzed help to explain the difficulties associated with conducting interdisciplinary work in this area. These three, which I refer to as: (1) group dynamics, (2) the systems approach, and (3) the farmer's system, are discussed in the subsections which follow.

Group dynamics

A considerable amount of research has been conducted on group dynamics (see for example Hare et al. 1955). Whether one is engaged in research or other types of activities, factors such as size, composition, and leadership make a considerable difference in the efficient functioning of the group.

Interdisciplinary research adds still another obstacle, the problem of communication. In this respect distinction is often drawn to the gap between social and biological sciences. My own experience is that there is often even more difficulty in communication within the social sciences. Problems of interdisciplinary communication unfortunately are as prevelant among scientists from the developing as the developed world. The former have inherited the disciplinary biases through advanced training in developed countries.

It is my judgement that there are definite limits to the size of a farming system team. The value of adding an additional member or discipline must be weighted carefully against the diseconomies of coordinating a group of larger size. The upper limit would seem to be about six. In the sondeo approach to establish the research agenda a relatively large group may function efficiently in the manner described by Hildebrand (1978). But in the actual conduct, evaluation, and reporting of research even six may be too large for the core group.

In the selection of team members important factors to be considered are the willingness and ability of individuals to participate in a team, applied-research, systems approach and the individuals knowledge and understanding of farmers and farming. An understanding of systems and farmers is a prerequisite for farming systems research.

The systems approach

Adding to the difficulty of working together as a group is the need to understand and master what for most scientists is a totally different approach to scientific research, systems analysis. My remarks in this session draw heavily on a recent article by Dillon (1976) which I recommend as must reading to anyone concerned with the general topic of farming systems research.

Most of us have grown up in a world in which the furtherance of the discipline is taken as more important than the solution of people's problems. This is but the inevitable consequence of specialization and reductionism. Since the 1950s there has been a growing reaction to this trend and expansionism, taleogy, and synthesis are now being recognized by science as necessary modes of thought for understanding the world. It follows that a systems approach, based on teleological concepts and means-ends analysis, is slowly being introduced as a necessary corollary to the inadequacies of the old hypothetic-deductive method of research as a means of assessing goal seeking and goal setting systems. In this new approach, man consumates the system, and defining the "right" objective becomes more important than making the "right" choice between alternatives.

Dillon (1976) refers to the systems approach as a new technology. He is quick to point out that rapid adoption is unlikely since academics represent perhaps the most conservative purposive element of the agricultural system.

There is, of course, not a single system within agriculture but rather a whole hiearchy of systems of which the farmer's system is only one sub-system. However, given the dominant role of the farmer in this sub-system and of man as either producer or consumer in higher order systems, the implication is that the socio-economic sphere is more important than the physical and biological sphere in the choice of research directions.

Traditionally our research has been production oriented. This production orientation has been transferred to the developing countries through the training of scientists in our tradition and is still dominant today in the international agricultural research network. The success of this system in terms of the traditional orientation of research has tended to emphasize its short-comings in the modern context of the systems approach. Improving merely a part of the system or a sub-system cannot be presumed to lead to enhanced performance of the overall system. Although it is politically more expedient in the short run for agricultural scientists to ignore the socio-economic consequences of their work, there is obviously no guarantee that research progress in the traditional mode will lead to social justice. The growing interest in farming systems research stems in large measure from a recognition that research efforts of the recent past have not resulted in social justice for the resource poor farmers of either the developed or the developing world.

<u>The farmers system</u>

Gotsch (1977) suggests that "the farmer's system" is a more appropriate term than "farming systems" since it lays the emphasis where it should be. Enterprising graduate students in the Agricultural Economics Department at Cornell recently have been selling for one dollar a pin which reads "No Farm Background." Most of our graduate students and a good many of our faculty are qualified to purchase such a pin. And if we were to change the title to "No Contact with Farmers this Year" even more would qualify.

During the early part of this century students and faculty alike came primarily from farming backgrounds, and they brought with them an appreciation of rural values and a capacity to communicate with farmers. I would argue that a lack of experience in American farming is a handicap to many scientists engaged in applied research to assist the farmers of developing as well as developed countries.

Often the weakest link in farming systems research is the communication (or lack there of) between scientist and farmer. This problem and some suggestions to improve communications are the subject of an excellent paper by Chambers (1980), "Understanding Professionals: Small Farmers and Scientists."

Unfortunately, much of what passes for communication today takes the form of an interview questionnaire now referred to professionally as the "survey instrument". The trend toward the use of the survey questionnaire is as pronounced in the developing as the developed countries, since surveys tend to be rather cheap and easy to administer. The problems come later when one attempts to transfer the data to computer tape and analyze the results. Without minimizing the importants and utility of good surveys, we need to consider more carefully alternative ways of communicating with farmers particularly in identifying their goals and objectives, in evaluating their methods of classifying resources, and in valuing indigenous technological knowledge. In this task it would appear that rural sociology and anthropology should have an increasingly important role to play in the farming system team.

Implications for Training

Dillon (1976) indicates that the adoption of the systems approach to research will require a complete shift in the emphasis on professional training. He suggests instead of the typical pattern, an initial (one year) introduction to the systems approach followed by a (two year) period of disciplinary specialization, capped off with the bringing together of different disciplines in the context of some relevant agricultural system.

In its most fully developed form, this approach would call for a new set of majors to replace traditional disciplines such as agronomy, plant breeding, and agricultural economics. Systems majors might include such titles as crop-soil systems, plant-animal systems, or farming systems. Research funds would be reallocated accordingly to multidisciplinary groups or systems teams. Dillon's view may represent nothing more than a vision of the distant future which many scientists would regard with fear and trepidation. But there are already signs that some of these changes are coming to pass, not only in the newly formed international research centers, but also in the more hallowed universities and colleges of agriculture.

Ealey (1979) describes a program for training environmental managers to work in multidisciplinary teams. Monash University in Australia offers a Masters of Environmental Science. A core staff of three faculty organize and administer the program and coordinate the activities of some 80 other staff members from all faculties who teach or supervise over 100 candidates.

The program consists of a course work component and a research component. The course work is intended to broaden insight and provide an opportunity to improve the depth of understanding in areas of previous training. The research component is designed to provide practical training in a multi-disciplinary group research. Teams of three to five candidates, each one from a different discipline, work together on a part time basis over a two year period. Each candidate is involved in the production of two documents, a group report integrating the work of the team and a minor thesis which details the work which each individual performed as his/her contribution to the group report.

Efforts at interdisciplinary research and training at Cornell have been more modest than those described above, being based on individual projects rather than on a program. Perhaps, the most ambitious of these involved 14 faculty and graduate students from 7 disciplines in a study of nitrogen and phospherous in the environment (Porter 1975).

Another project involved six disciplines at Cornell linked with the CIMMYT corn program. PhD students from each of these disciplines -- agricultural economics, agronomy, biometry, entomology, plant breeding, and plant pathology -- did their research on various aspects of corn production with field work being conducted in Mexico (Contreras et al. 1977).

A course in water management was initiated in the mid-1970s with instruction from faculty in three disciplines - agricultural engineering, agricultural economics, and rural sociology. The faculty teaching this course developed a US/AID supported research project, "The Determination of Developing Country Irrigation Project Problems," with field work being conducted in South and Southeast Asia. The course provides a training ground for graduate students who have later participated in the US/AID project or have returned to conduct water management research in their own countries.

Our only ongoing farming systems research project is entitled, "Technology Introduction into Traditional Farming at High Elevations." Two graduate students, one from rural sociology and one from plant breeding, are just completing a study of farming systems in the Andean Mountains of Equador where they have lived in a small village with their families for the past two years.

Following the model used in water management, we have been experimenting this fall in the development of a course in farming systems. Ten faculty and twenty-four students have been involved in this experiment. Approximately 50 percent of the time was devoted to weekly discussions usually based on presentations of one or two faculty members. The other 50 percent of the time was spent in small group exercises. Students were divided into four mixed discipline teams of six members and asked: (1) to present a case study of farming systems research, and (2) to identify and study a local (New York

State) group of farmers in order to be able to describe their farming system and suggest a research agenda.

I will not go into any further details regarding this course, which is just now coming to an end, other than to say that it has tended to high light the barriers to interdisciplinary research that I have described in this paper. Faculty presentations tended to emphasize the familiar discipline approach rather than the systems approach. The field exercises proved to be valuable if for no other reason than providing most graduate students with their first opportunity to interview American farmers.

Concluding Remarks

In this paper I have not dealt directly with what we understand by the term "farming systems." But as a minimum it would seem that farming systems research should consist in its initial stages of an interdisciplinary team undertaking: (1) a wholestic systems look at the farm and farm family including non-farm activites, and (2) an interaction or dialogue with the farmer or farm family. Both of the above elements should have the purpose of aiding in the identification of the appropriate researchable issues. Based on these criteria, there are very few studies in the literature today which could properly be classified as farming systems. New concepts of interdisciplinary training are clearly needed to prepare people for research in farming systems.

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FARMING SYSTEMS RESEARCH PROGRAM[1]

STRUCTURE, STAFFING and FUNDING

Jerry L. McIntosh[2]

Introduction

Farming systems studies of various kinds by teams of agricultural scientists have been a consequence of the concern for development of more appropriate technology. In countries where most of the food consumed comes directly from crop production, the research has been called cropping systems. Under these conditions there may not be much difference between farming systems and cropping systems research. In cropping systems research, although the emphasis is on crops, all related farm activities are also usually considered; from land preparation, which includes animals and family labor, to marketing, which involves transportation and infrastructural development. Consequently, cropping systems research is a coordinated and integrated interdisciplinary effort to develop technology that will enable farmers to increase food production in a way that is acceptable to them. This simple condition "acceptable to them" must not be overlooked. This socio-economic aspect has been overlooked many times in the past and is one of the prime reasons why farmers did not or could not accept the new technology.

In order to have effective research where limited funds and personnel exist, much of the research in agriculture should contribute directly to development needs and government production programs. The research should

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[2]Cropping Systems Agronomist, Cooperative CRIA/IRRI Program in Indonesia

be (1) systematic and directed to specific target areas to provide the most efficient use of the research funds and personnel, and (2) it probably should be conducted on farmers' fields in order to approximate farmers' conditions and understand the constraints farmers face. It should be an interdisciplinary effort that is well integrated with related government agencies. If we can describe the agroeconomic environments of the target areas well, we should be able to transfer research technology from one area to similar areas and save considerable time and research effort. Staffing and funding arrangements associated with a comprehensive agricultural research effort such as in a farming systems program are vital to the success of the program. These are administrative matters that will vary from country to country. But some guidelines may be given that are based upon experience from existing programs.

The objective of this presentation is to describe a cropping systems research program and illustrate the role of socioeconomic as well as ecological determinants in the description, design, and implementation phases of the research and, ultimately, transfer technology. The approach described is designed primarily to meet the needs of small farmers in developing countries where there are limited funds and personnel for agricultural research and development. Much of the information presented is a condensation from previous papers describing cropping systems research in Indonesia. Consequently, this paper will only briefly outline the essential points relevant to a farming systems research program.

Cropping Systems Research

Cropping systems research is a coordinated and integrated effort to develop technology that will enable farmers to increase food production. The technology must be acceptable to the farmers who will use it. In some cases it may be desirable to identify and remove constraints to the farmers through government programs. The increased production may result from better management of present cropping patterns, introduction of an extra crop(s) per year (intensification), or expansion of crop production into newly opened or under-used land areas (extensification).

The research is carried out by a coordinated group of scientists from various disciplines. It is focused upon specific target areas to make more efficient use of research staff and funds. The selection of target areas for cropping systems research is very crucial. The Indonesian cropping systems program emphasizes the following criteria for selection of target areas:

1. Critical areas in terms of food shortages and governmental designation.
2. Large areas having similar soils and climate.
3. Feasibility of intensifying cropping patterns based on prior evidence.
4. Availability of markets and infrastructure.

A diagram for the cropping systems program in Indonesia (Fig. 1) shows five distinct phases, associated research activities and approximate time frame that follw after selection of the target area. The objectives of the research within a target area should be specific and attainable within a defined period of time. The research effort should be allowed to develop a broader research base and perhaps become a farming systems research program but only in a logical and stepwise manner. It is in this context that the farming systems terminology is used in the remainder of this paper.

Staffing and Funding of Farming Systems Research

A cropping systems research program that evolves from the activities of research scientists is likely to be more effective and long lasting than a program that is conceived and implemented from the top. But unfortunately, the evolutionary process may take a long time. A combined effort from the administrators and from the research scientists would be most desirable. This kind of approach has been effective in Southeast Asia for development of programs for Genetic Evaluation and Utilization (GEU) for rice breeding and Cropping Systems Research. These are interdisciplinary research efforts that are complementary. The efforts of IRRI and international funding agencies provided the access to the research administrators. The collaboration of scientists through regional research networks for GEU and Cropping Systems provided the stimulus at the research level. Fig. 2 illustrates how these programs may function within a national food crops research institute. Staff would be available from the usual divisions (or disciplines) of the institute, hopefully on a voluntary and part time basis. Funding through the programs would provide the incentive to work together.

Farming Systems Research, on the other hand, would involve scientists from several research institutes. The research program would likely be organized at a higher echelon within the ministry of agriculture than for a cropping systems research program (Figs. 3 and 4). Again funding would flow through the program to the research scientists as indicated in Fig. 5. The existing research operations supported by routine funding would continue to function within the various research institutes and directorate generals. Special funds as seed money would probably be needed to encourage active involvement in the programs. This is the place where some outside help may be needed in terms of technical and financial assistance.

Organization of the Research Program

An effective farming systems program depends to a great extent upon the Coordinator. An effective coordinator will likely move up quickly to higher positions within the government. This dilemma can be overcome to a certain extent by developing collective leadership through a Farming Systems Working Group. Fig. 6 illustrates how a national cropping systems research program was organized to direct its research activities and coordinate the activities of regional research centers which have varying degrees of autonomy (Fig. 7).

A farming systems research program should be an interdisciplinary effort. But it should also be integrated with other governmental activities. Rural development programs and extension, local government and irrigation agencies are examples of government programs and agencies that must ultimately be involved in the implementation of the results of farming systems research. Their involvement at early stages of the research programs is vital. Fig. 8 illustrates the level and time of involvement of different sectors of the bureaucracy. This kind of integration facilitates the development of relevant technology, implementation of the results and smooth transfer to other areas with similar conditions (Fig. 9). Fig. 10 illustrates how government interventation in terms of production programs is helpful to farmers. Many times farmers can do little without this support. We cannot expect farmers to immediately adopt technology that was developed over a period of 5-10 years by scientists under conditions where inputs were available and where no individual risks were involved. Even though farming systems research may develop more relevant technology than traditional commodity and discipline oriented research, the technology will likely be more complex and dependent upon a wider range of social and governmental group involvement.

Manpower Development

It is the feeling of may people working in farming systems research projects that the real payoff from this research is in manpower development.

A strong sense of accomplishment and enthusiasm develops among many of the staff. This provides an ideal opportunity to identify those scientists who are stimulated by real problems that farmers face and who can work in interdisciplinary teams. Short term training with colleagues from other countries at international centers such as IRRI provides a good background fo young researchers in new cropping systems programs. This kind of training should be complemented by opportunities to meet periodically at regional workshops and conferences. These kinds of training opportunities will probably need support from out of country funding agencies. It would be useful to have available a broader range of training programs than presently exist. Advanced degree studies should also be provided. Usually there is sufficient funding for this. It is more difficult to identify centers of excellence for such advanced studies.

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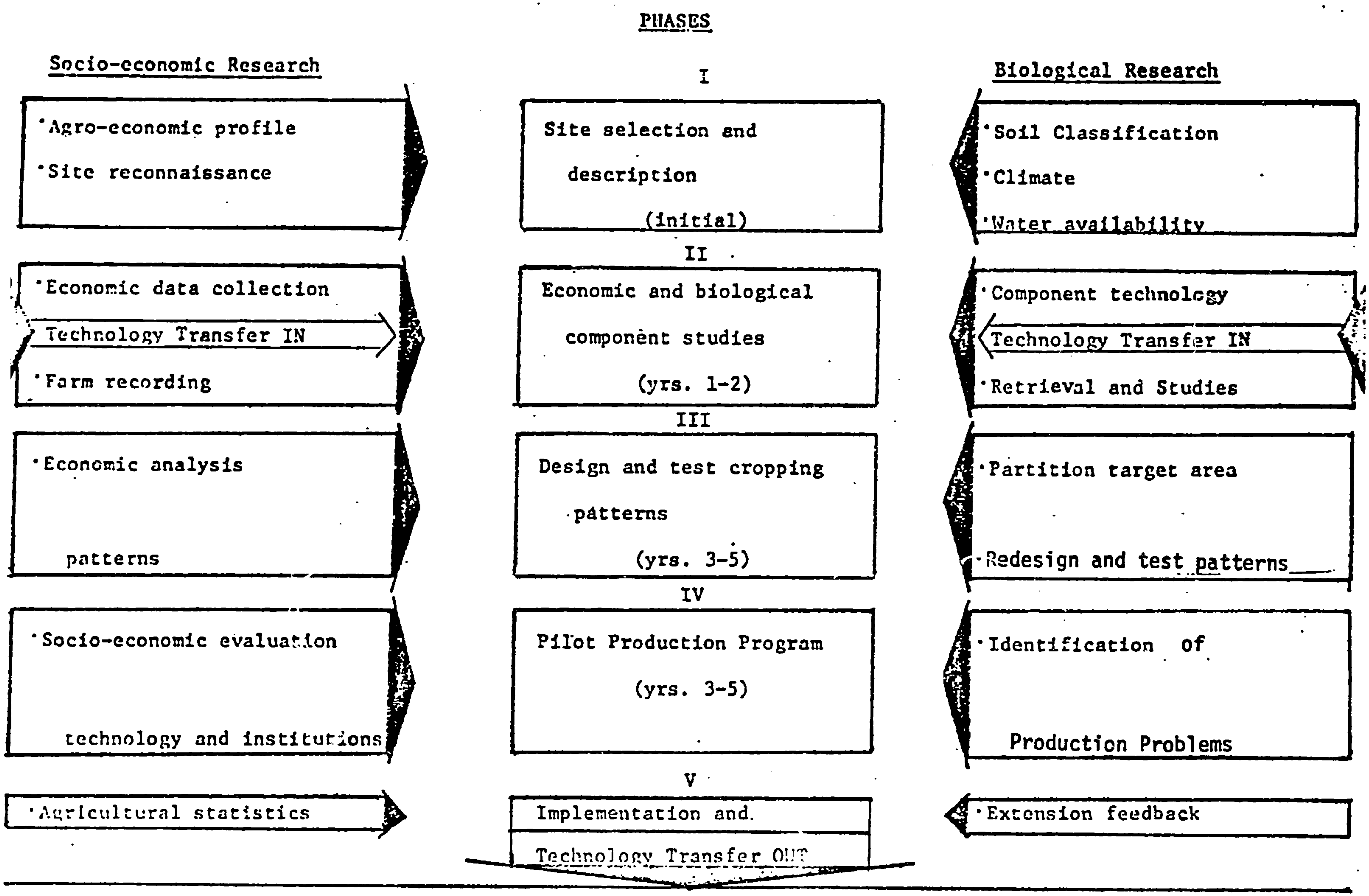
CROPPING SYSTEMS RESEARCH PROGRA[illegible] SELECTED TARGET AREAS



Parallel biological and socio-economic act[illegible]ies, required for the five distinct research implementation phases of a cropping system[illegible]bgram with little inflow of technology

FRAMEWORK FOR CROPPING SYSTEMS RESEARCH PROGRAM

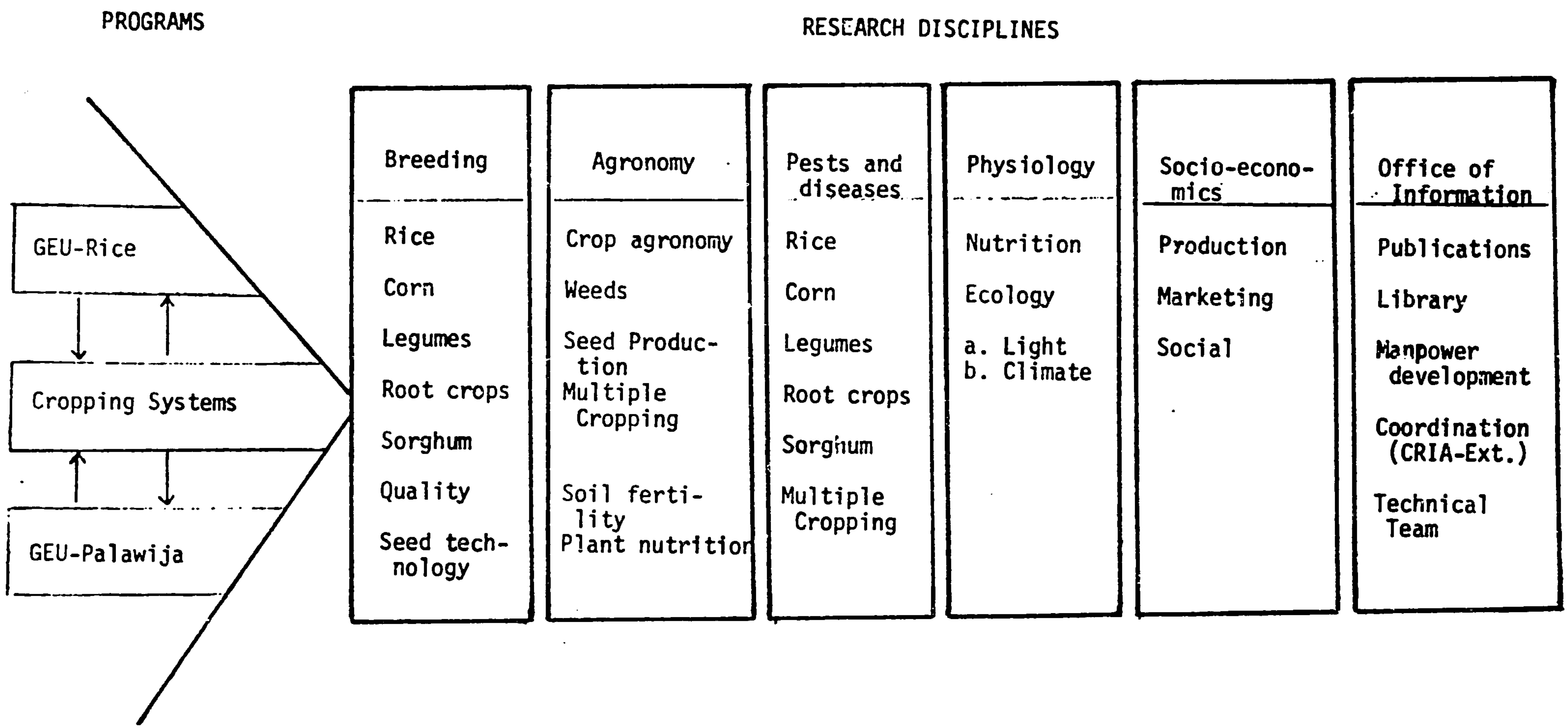


Fig. 2. Interaction among programs and traditional divisions in a Cropping Systems Program.

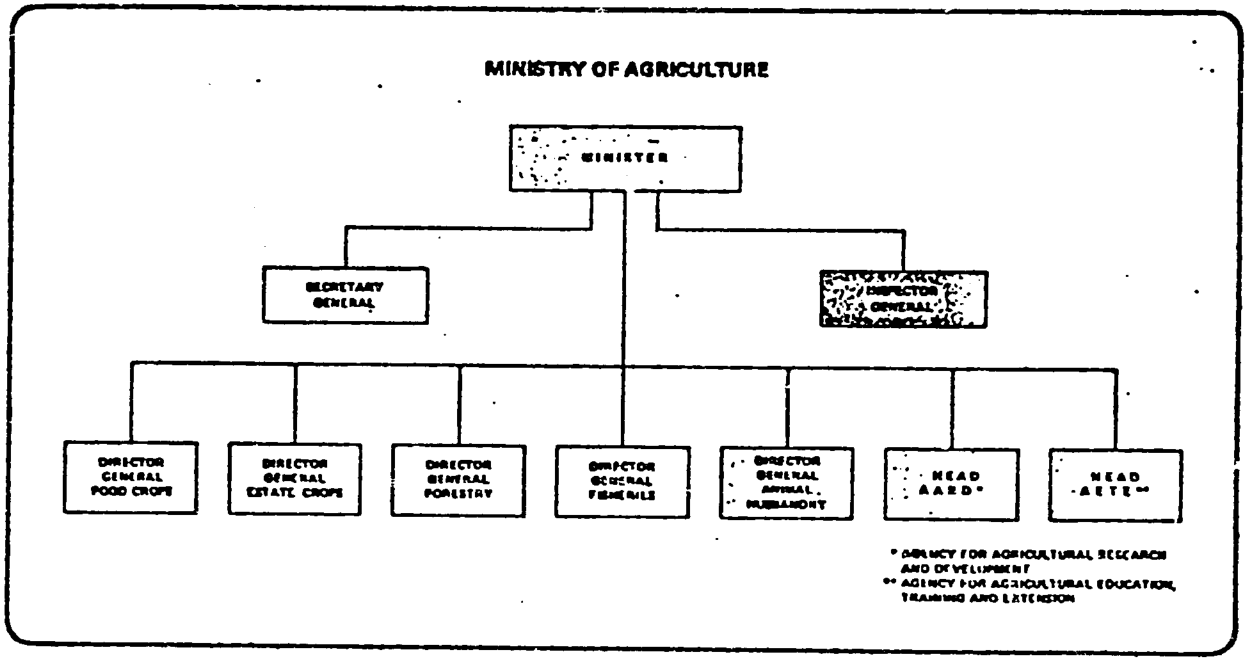


Fig. 3. Organizational structure in Ministry of Agriculture.

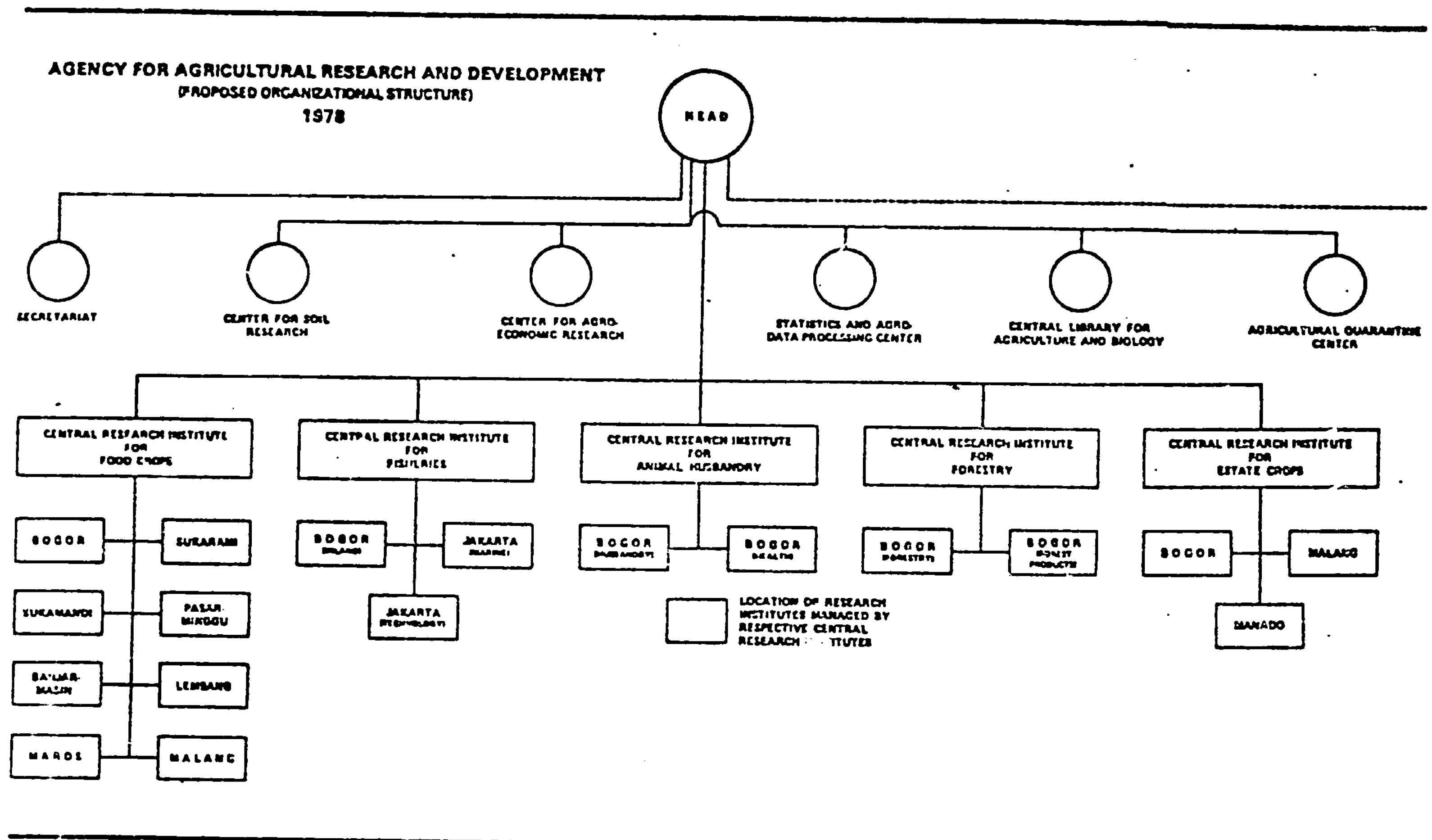
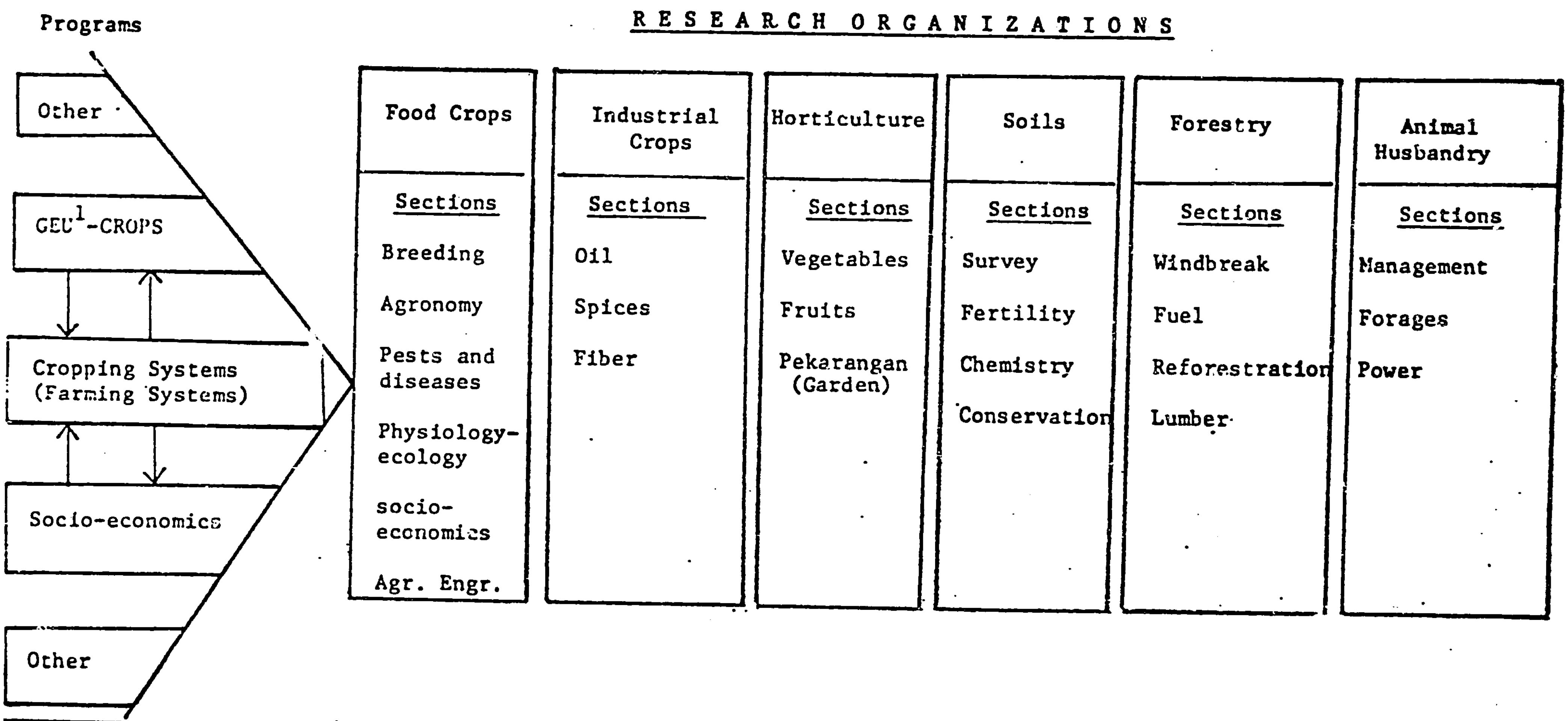
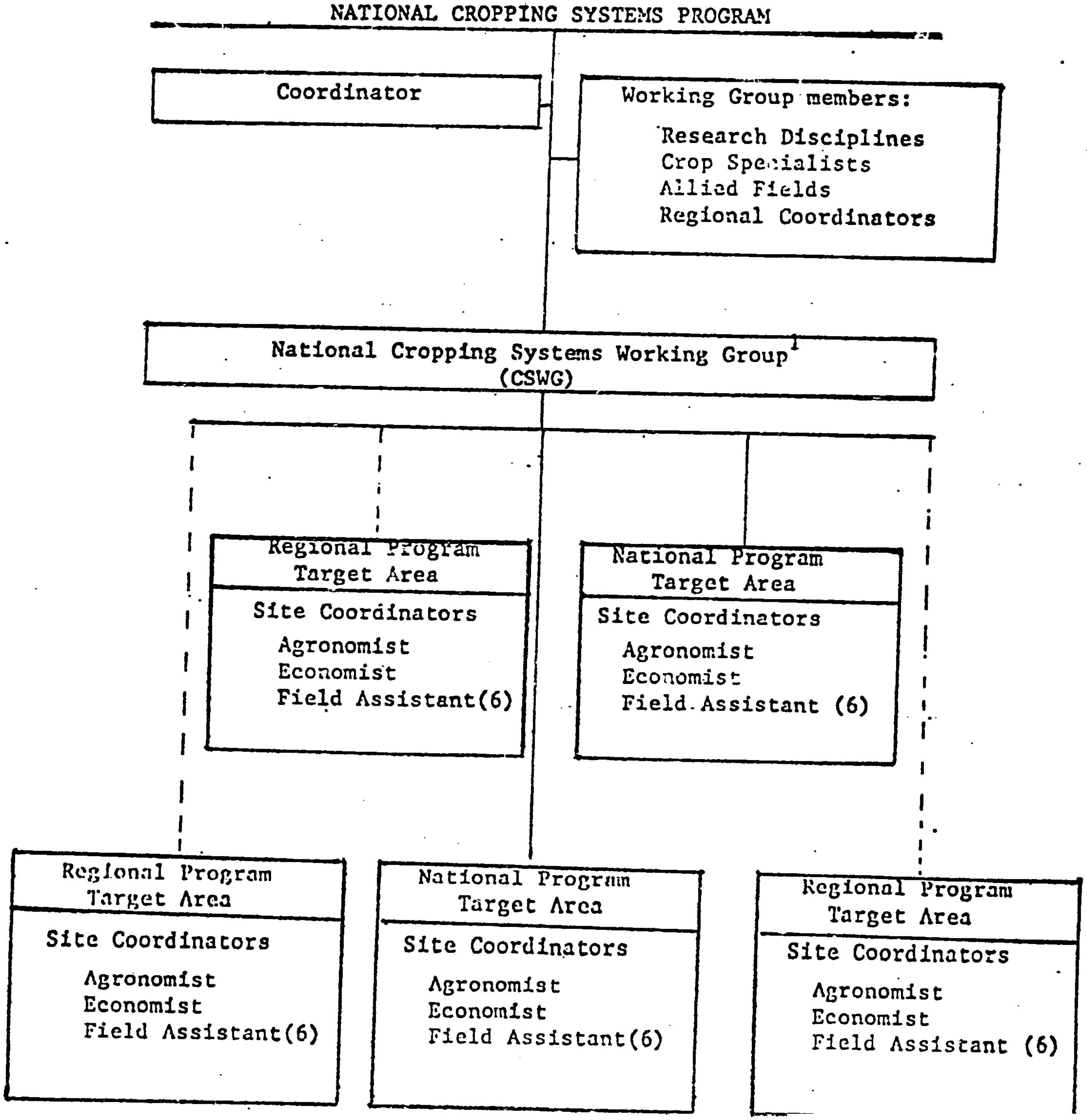


Fig. 4. Organizational structure of the Agricultural Research Agency.



[1]GEU--Genetic Evaluation and Utilization refers to systematic varietal improvement studies for food crops such as: rice, corn, legumes, etc.

Fig. 5. Interaction among programs and traditional commodity and discipline-oriented research activities in a Farming Systems Research Program.



ig. 6. Organizational structure of a Croppin stems Program.

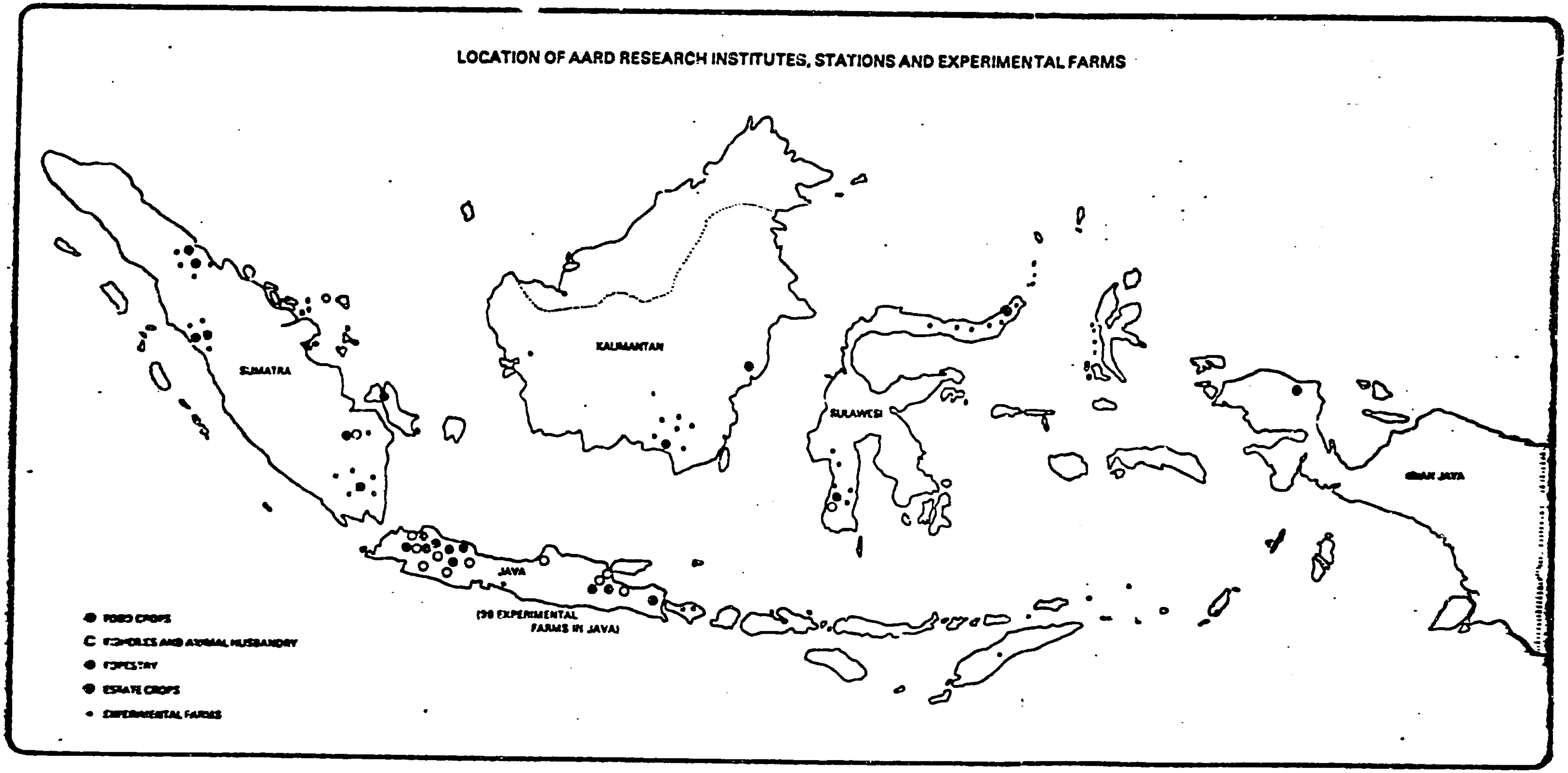


Fig. 7. Locations of facilities for agricultural research in Indonesia.

Research-Extension interface over different phases of a cropping systems program

	RESEARCH & IMPLEMENTATION PHASES					
Target Area Selection	I Site description	II Econ & Biol. Pot'l	III Design & Test	IV Pilot Prod.Prog.	V Implementation	Technology transfer
CSWG[1]	CSWC	CSWG	CSWG	CSWG	CSWG	CSWG
Extension Local Gov't. Nat'l Gov't.	Extension Local Gov't.	Extension Farmer Local Gov't. Bureau Stat.	Extension Farmer Local Gov't.	Extension Farmer Dir. Prod. Local Gov't.	Extension Farmer Nat'l Prod.Prog Local Gov't.	Extension Other Nat' Gov't.Agen

[1]CSWG--abbreviation for cropping systems working group which is the multi-disciplinary research group that coordinates and carries out the research plans of cropping systems programs in a target area.

Fig. 8. Research-extension workload distribution and interaction with farmers and other government agencies in different phases of cropping systems research and

CROPPING SYSTEMS RESEARCH PR FOR SELECTED TARGET AREAS

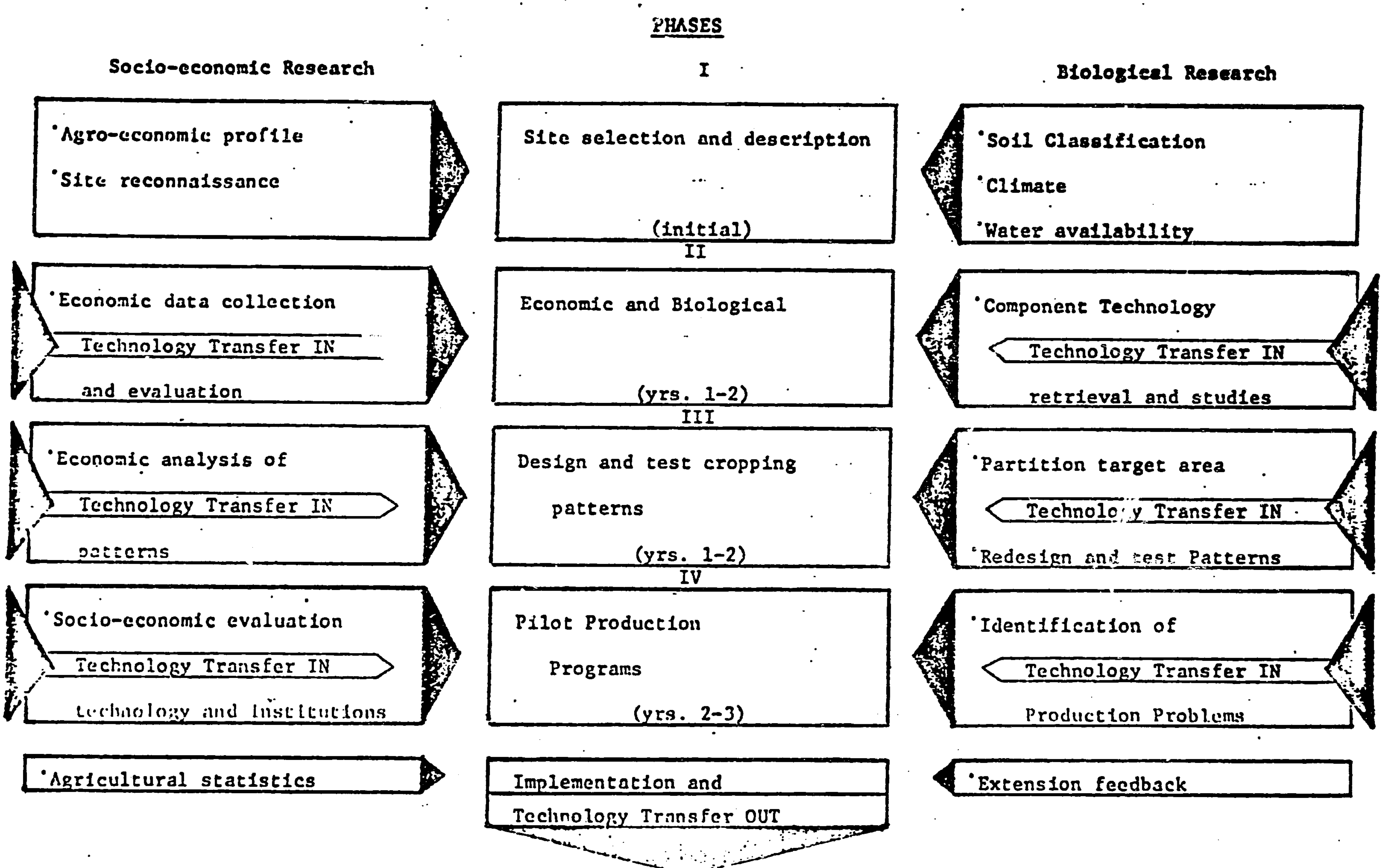


Fig. 9. Time frame for research and implementation phases of a cropping systems program with significant inflow of technology from research in areas with similar site descriptions. This technology transfer may reduce the research time in a target area by two or more years.

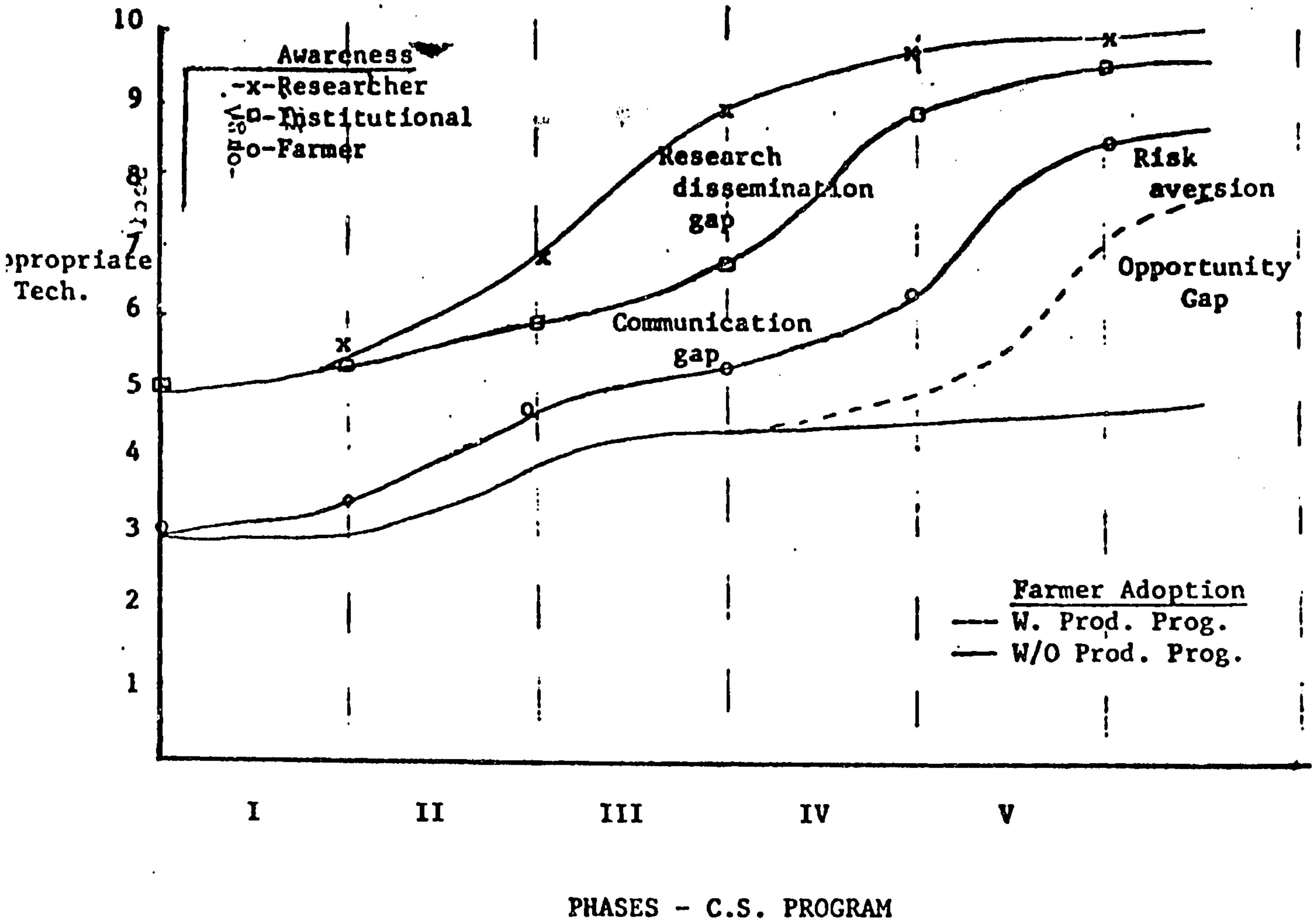


Fig. 10. Research development, dissemenation, and implementation with respect to sequential phases of a Cropping Systems Project in an underdeveloped target area.

FSR AND NATIONAL AGRICULTURAL DEVELOPMENT

Peter E. Hildebrand[1/]

FSR and National Agricultural Policy

National agricultural policy can have a profound effect on an FSR program, and in turn, the FSR program can, and should, have an effect on national agricultural policy. The relative emphasis a country places on export versus food or subsistence crops is closely related to the emphasis on small farmers. Export crops usually are produced on larger farms and plantations while food crops are produced on nearly all small farms. Because FSR has been developed principally to work with small farmers, the relationship is obvious.

Stability of agricultural policies toward small farmers is equally important. The organization of an FSR program requires time. If the policy of a country changes rapidly, it is likely that the orientation of the research unit will also be required to change. A program that shifts emphasis frequently will never be able to become efficient in its operation.

Either an operational FSR program or a short term FSR-type project created specifically for the purpose, can serve as an important source of information and orientation for national agricultural policy decision makers. Feasibility of projects aimed toward small farm development can be assessed much more realistically through an FSR program working directly with small farmers than via "informed agriculuralists" who seldom, if ever, set foot off an experiment station or out of an office. Errors in goal assessment and determination, and in feasibility, frequently occur because the wrong

[1/]Visiting Professor, Food and Resource Economics Department, University of Florida, Gainesville, Florida.

question was asked, the question was incorrectly interpreted, or the "informed" source was not in close enough contact with reality to make a correct response.

FSR and Developmental Infrastructure

Developmental infrastructure such as roads, markets, price supports, credit, research, extension and cooperatives are all important elements in national agricultural development schemes. Their impact on small farmers can be great and they all tremendously influence the kind of technology a small farmer will find feasible and acceptable to use. Many development projects depend heavily on developmental infrastrucutre to create feasibility.

A realistic assessment of the impact of schemes to improve infrastructure for small farmers leads to disillusion, however. Long delays are the rule. Only a limited number have affected more than a few small farmers in pilot projects. Technologies recommended to small farmers, when based on the existence of developmental infrastrucutre "to be developed" are non-economic, not feasible and unacceptable to the small farmer in its absence. Hence realistic assessment "from the trenches" leads many FSR practitioners to consider non-existent, proposed or malfunctioning developmental infrastructure to be just another restriction or parameter which constrains the small farmer's options as much as rocky soil, cultural taboos or labor constraints.

These same practitioners, however, can and should provide a service toward the provision of effective developmental infrastructure. First, the FSR technician can inform policy makers of the need for certain classes of infrastructure. Second, he can help the policy maker better understand the effects to be expected from alternative infrastructural investments. Third, he can

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advise the policy maker on the types of technologies which might be feasible and acceptable under different alternatives. And fourth, he can help design the infrastructure to best meet the needs of the clientele group.

Under the above "model" the technology developed for the farmer depends on the nature of the infrastructure that exists at any one time. If new infrastructure is put into place, and it functions, new technology can be developed in response.[1/]

A means of incorporating an FSR program actively in infrastructural development is proposed in the IDIAP project in Panama. In this model, a representative of each regional infrastructure agency will be placed on the IDIAP-FSR team. He will participate as a member of the IDIAP team but will also serve as a liaison with the parent agency. In theory, this will permit the agency to be actively aware of the activities of the FSR team so that alternative strategies can be based on realities and the team can have an active input into the design of the infrastructure. Hopefully, in this model, the promise of future infrastructure can be depended upon and the infrastructure will more nearly reflect the real needs of the region's farmers.

FSR and Measures of Development Impact

The primary objective of the FSR approach is the generation of technology appropriate for and acceptable to the target clientele group. For most national reserach programs, effectively carrying out this mandate does not leave resources for the kinds of activities required to measure regional or national

[1/] Realistically, of course, certain lead time is required to develop the technology. Hence a certain amount of faith is required to begin to develop technological options in advance of the development of the infrastructure.

institutions and result in lowered productivity when undertaken. Other means of measuring impact which are more amenable and meaningful to an FSR program exist.

One such measure, which lies within the normal operational capability of a national FSR program and provides a direct and meaningful input to it, is an estimate of the proportion of target farmers (those in the recommendation domain) who are in fact, adopting the recommended technology. The underlying assumption which makes this measure useful to funding or policy making agencies is that if the farmers are using the technology, it must be good for them. To learn how, or how much it is good for them is more difficult and not necessary. For example, an improvement in maize production technology in the Central Highlands of Guatemala may result in an increase in vegetable production while having little affect on total production of maize. Had a baseline study been undertaken for a "maize improvement project", information may not have been accumulated on vegetable production. If not, the project would be impossible to evaluate under usual impact evaluation procedures, and the efforts taken to carefully measure maize production "before and after" would show no progress had been made.

Summary

An FSR program can and should have an important effect on national agricultural development. The first, and direct impact, is on the productivity of target farmers. The program can also have an important impact on the nature and appropriateness of policies related to national agricultural development for target farmers and in the infrastructure to support this development. But in the short-run, an FSR program will be more effective if it

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considers developmental infrastructure as a parameter and develops technology accordingly. As their efforts to improve infrastructure by cooperating with appropriate agencies came to fruition, new technologies can once again be developed to take advantage of this new resource.

ISSUES OF FSR EVALUATION

Willis W. Shaner*

I. INTRODUCTION

A. Asked to speak on:

1. Criteria for evaluating FSR programs

2. Examination of feasibility of cost-benefit analysis

3. Survey of FSR program results achieved thus far

B. Approach: will cover

1. Statement on the purposes of evaluation

2. Statement of FSR: what it is, characteristics, & steps in the process

3. Basis for evaluation: over-riding criteria

4. How to evaluate: approach (including B-C) as related to the various steps in FSR

-- In the process will discuss some evaluation procedures actually in use.

C. My involvement with FSR and Evaluation

1. Nearly completed with a 2-1/2 year study of FSR&D methodology

--a synthesis of current practices around the world.

2. Have worked on a lot of feasibility studies involving B-C techniques

3. Have been on one evaluation team; but no great insight into comparative methods

II. What are the purposes of evaluations?

A. Built-in evaluations to provide a check on project activities

--Perform a management function.

B. Special evaluations of particular aspects of a project

--Usually occur when problems arise and a quick solution is needed

C. Impact evaluations on how well the project has done

1. What has the project accomplished?

*Associate Professor, Colorado State University and Project Director for Consortium for International Development Farming Systems Research and Development Guidelines Project.

Pg. 2: ISSUES OF . . .

2. Used for a) understanding the project,
   b) improving the approach
   c) setting policy
   d) basis for justifying financial support

D. Will consider primarily the first and third of these types of evaluations

III. Some comments on FSR

A. Characteristics

1. Primarily environmentally specific research aimed at the small farmer in developing countries--at least the perspective of the material we have been reviewing

2. Major advantage is that it develops technologies quickly for specific target groups--therefore, can say it is highly applied.

3. Major potential disadvantage is that it could concentrate too many scarce resources on too few farmers--therefore, need to come up with procedures that produce quick results that are broadly applicable.

4. One form of evaluation is to see how well the advantages of FSR are bein implemented and disadvantages are being guarded against.

IV. Basis for Evaluating a National FSR Program

A. Is good use being made of the funds?

1. Are dollars spent in research providing an adequate rate of return?

--general feeling is that they are and that more funds are needed.

2. Are the returns at least as good as other government expenditures?

--general feeling is that they are

B. Is FSR a better use of research funds than alternative research approaches?

1. This is more debatable: depends on the country's objectives.

2. EMBRAPA has felt that research along commodity and disciplinary lines was better than the interdisciplinary approach of FSR because
   a. Brazil was concerned with efficiency in food production

   b. Research is scale neutral so that small farmers can pick up the results on their own

   c. And if they didn't, that was a problem of implementation not EMBRAPA's.

3. Practitioners in FSR feel that FSR is a better approach

   a. Small farmers are worth reaching on production and welfare grounds.

   b. Can't easily change the support institutions, so work on improved technologies that take the existing situation into account.

C. Therefore an evaluation team can look into the effectiveness of FSR relative to other government expenditures and relative to other agricultural programs, in the light of the government's and the donor's objectives considering small farmers.

V. How to Evaluate an FSR project?

A. End results versus the process.

1. Ideally, measurement should be on the end results: i.e., what has FSR produced?

   a. Corporations will often give a manager a budget and responsibility over operations then measure his performance on his profit and loss record.

   b. Difference with FSR is that the benefits accrue to the farmers (directly, and with consumers indirectly), while the costs include the FSR&D program (researchers and extension) as well as those incurred by the farmers.

   c. Can pick some indicator of accomplishment, as with the introduction of a new variety, identify the benefits of its introduction (relative to the old variety); estimate the numbers of farmers accepting the new variety, which gives an estimate of total benefits; and compare with the costs to the farmers and of the R&D effort to bring it to the farmers

   --a major problem is that R&D effort involves many outputs, not just a new variety

   --also, some of the results of the R&D effort have long-run effects not embodied in the measurement of the benefits of a new variety: e.g.,

   --something may be learned about other components (e.g., fertilizer application, cultivation, planting time) and about other commodities that may respond similarly, or in association

   --farmers may be more effectively introduced to change so that they will respond more positively to new technologies introduced in the future

   --researchers and extension may become more efficient by learning how to work together in solving farmers' problems

   --these are indirect and dynamic aspects that are more difficult to quantify in some form of B-C calculation

--best to do this qualitatively and in comparison with alternative approaches.

d. A conceptual problem with indicators such as the one just mentioned is that they give only part of the picture (are benefits greater than costs); they don't say how well the farmers would have done had some other approach to R&D been followed

--consequently, some attention needs to given to showing that the results are significantly different from those achieved by other methods.

--setting up some form of historical record or comparisons with other areas during the same time period should help

2. Alternatively, evaluate the FSR process.

a. When results are difficult to measure satisfactorily, can switch to an evaluation of the process on the assumption that adequately carrying out the process leads to satisfactory end results.

b. Such an approach helps the managers and staff of the project and is a form of built-in evaluation; it is less satisfactory in convincing higher-level decision makers about the value of the project

B. Suitability of Benefit-Cost Analyses

1. Definition of Benefit-Cost Analyses

--Identification and quantification of benefits and costs of alternatives using some common measure of value (usually money)

2. Advantages of the approach:

a. Forces the evaluator to logically think through the proposal

b. Forces the evaluator to consider alternative approaches

c. Produces results that are in terms suitable for aiding in the decision as to accept or reject a proposal

3. Some difficulties with evaluating research

a. Doesn't work very well when benefits and costs (usually benefits) cannot be identified--where the indirect or secondary effects are diffused

b. Nor does it work well when it is difficult to put a monetary value on the inputs or outputs--either because they are not subject to easy quantification in physical terms, the items are not normally traded in the market, or society (alternatively the government) hasn' agreed on how to value the inputs or the outputs.

--For example, B-C analysis is not particularly useful for government decisions aimed at price stability, political objectives, income redistribution, or quality of life (e.g., what's the value of greater national security in terms of benefits to society?)

4. For such cases let a standard be set by the government then through cost effectiveness techniques find the least cost alternative, or still better investigate the performance-cost relationships to help in setting an acceptable level of performance and expenditures.

A. As applied to FSR;

1. Because FSR is directed to solving specifically identified, farmer problems and has a strong emphasis on increases in agricultural production, B-C analyses are more applicable than when research is more broadly applicable, or basic in nature.

2. Also, the applicability of results are generally for specific target areas, or sub-areas (recommendation domains as CIMMYT calls them).

3. Therefore, both the specific values (increased production has either a direct market value, or an imputed value if consumed by the farm household) and the applicability is defined as potentially those in the target area.

4. In this sense B-C analysis techniques are more applicable to FSR than perhaps most other types of agricultural research.

B. Evaluation applied to FSR steps

1. FSR&D steps shown on diagram (Figure 1) include:

   a. Target area and research site selection.

   b. Problem identification and development of a research base

   c. Research design and planning

   d. On-site reserach and analysis

   e. Extending the results

   f. Research at the experiement station is set off to the side to stress its collaborative role.

2. First major evaluation--applied to identified farmer problems and opportunities. Problems and opportunities are selected on basis of

   a. Solution could have a major impact--e.g., adding a second or a third crop.

   b. Seriouness of the problem--e.g., insect, disease, erosion

   c. Ease of implementation

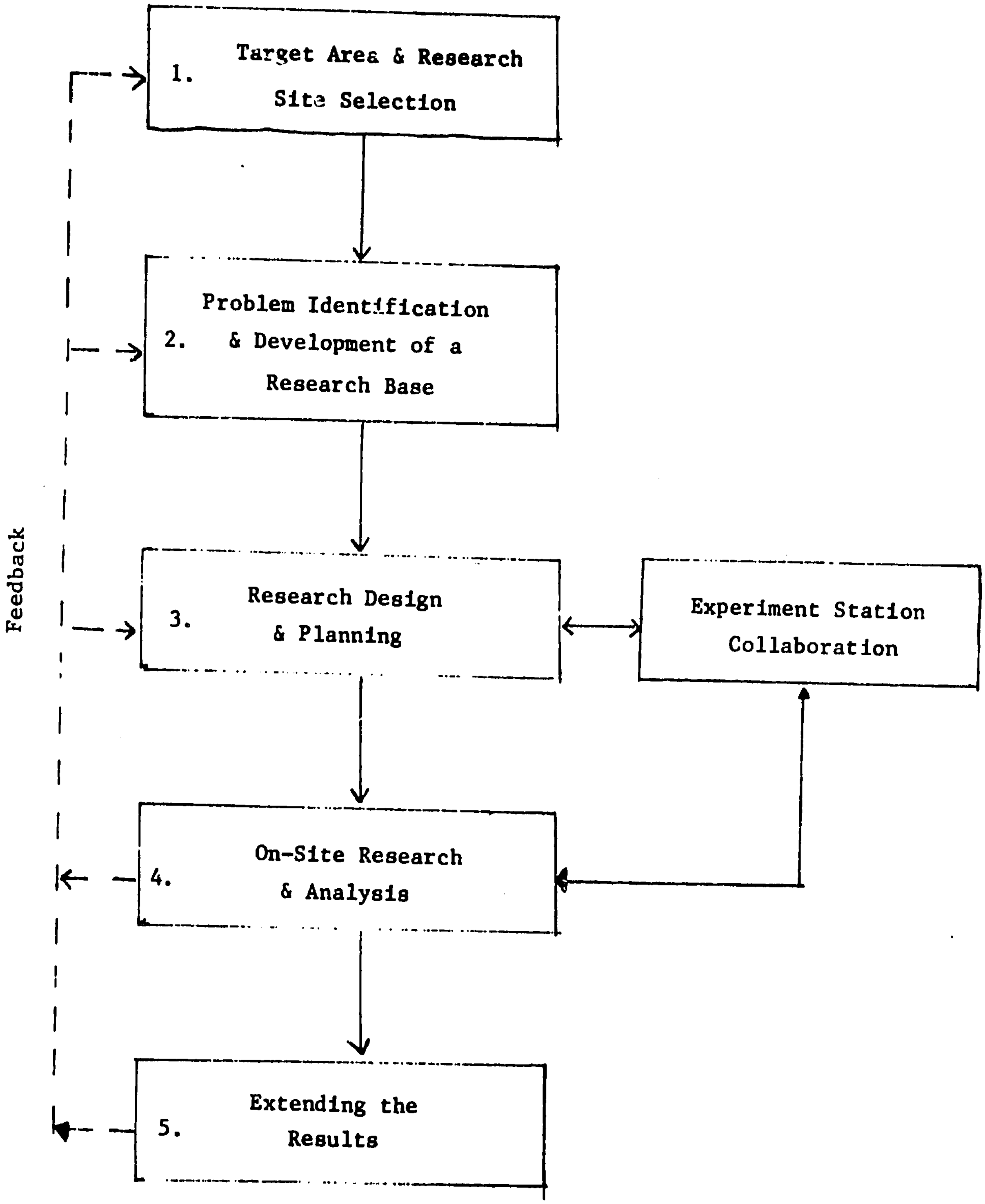

Figure 1. Generalized Steps in FSR&D

3. Second major evaluation -- a preview of research results, i.e., what is the likely outcome in terms of

a. Net benefits to the farmers

b. Stability of results, which leads to

c. Likelihood of acceptance

d. The required support services and policies

If results look ok, will proceed; otherwise, revise or reject.

4. Third major evaluation -- concerns results of the trials and tests

a. Biological performance, based on

-- statistical procedures for researcher-managed trials, superimposed trials, and farmers' tests

b. Resource requirements

1. What was actually needed to implement the technology

2. Requirements probably had to be modified in the light of farmers' practices.

c. Economic analysis

1. Benefits and costs to the farmer, involving imputed values for own consumption and inputs (mainly farmer's own labor)

2. Impact on society, involves

-- raising standard of living of the farmer

--producing a surplus for sale on domestic and international markets

3. Requirements for support from the private and public sectors

d. Financial analysis

1. Cash requirements versus availability

2. Concerns credit: costs and amounts

3. A technology may be economically attractive, but financially not feasible if farmers haven't the cash as needed.

e. Risk -- primarily that considered by the farmer, but could include the government's attitude toward risk. In terms of

1. Variability of outcomes

2. Cash requirements

-- Example from CIMMYT (Perrin, 1976) which analyzes biological results in terms of net benefits, dominance of some alternatives over others and sharp breaks in the rate of increases in net benefits from increases in variable costs.

3. Degree of change required

4. Whethe: crops or livestock are:

-- major or minor

-- subsistence or cash

f. Social-Cultural Analysis

1. Information about farmers and farmer-groups was considered earlier during the review of secondary data, surveys, and discussions with farmers who participate in experiments

2. Undertake social-cultural studies when results don't turn out as expected

-- usually when farmers don't accept a technology when the biological economic, and financial analyses indicate they should.

3. Means something was overlooked

4. This approach helps to focus attention of researchers on solving a particular problem; gets away from generalized studies that can take up so much time and often suffer from lack of focus.

5. Fourth major evaluation -- actual acceptability to farmers

a. How do they react to the introduced technology when they are not part of an experiment?

b. ICTA uses an Acceptability Index

-- Percent of farmers accepting the technology x percent of their crop divided by 100, gives an index from 0 to 100: 25 considered acceptable for promotion.

c. Some factors to consider

1. What's the unit impact? Could have a high acceptance rate, with little required change at high cost to develop the technology (not particularly likely, but the index does not pick this up)

2. What's the global impact?

-- How representative are the farmers being evaluated of the other farmers in the area?

-- If a good job is done on area and farmer selection, then the numbers of farmers should be known

3. How stable are the results over time?

--Could take time to learn how technologies perform under different environmental and management conditions

--Look for an improved technology that will take hold: could have slow initial acceptance if too complex for extension and farmers need training.

6. Fifth major evaluation - Multilocation testing

a. To test how well the technologies perform in stratified zones across the target area

b. Gives researchers and extension a chance to see how broadly consistent the results are and

c. What the capabilities of extension are

d. What modifications (usually minor) to be made to:

1. Technology to make it more broadly applicable and easier to adopt

2. Extension service to help them implement the improvements

7. Sixth Major Evaluation -- Pilot production programs

a. To test the new technologies on a broader scale (100 to 500 ha) and how they function under actual conditions.

-- a test of the support systems

-- e.g., how extension operates, availability of inputs (chemicals, seeds, etc.) credit, what happens to prices, availability of seasonal labor, etc.

b. Should lead to confirmation of the preliminary evaluation (second major evaluation) wherein assumptions about services, supplies, etc. were made.

c. If system doesn't support technology in fact, then investigate why

d. A decision point:

1. If better support or policies are needed, then a question for the government based on social B-C analysis

2. Modification of technology, given existing support system

3. Or drop the technology--probably too drastic a course at this point, but not necessarily.

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D. Concluding Comment on Evaluating FSR

1. So many different ways to apply FSR concepts, e.g.,

    a. Modification to existing research and extension programs within existing organizations, or promote a new organization with autonomy,

    b. As a project or program

    c. With a commodity orientation as with CIMMYT (wheat and maize), IRRI (rice) or ILCA (livestock) or as a general farming systems approach without initial emphasis.

2. A function of

    a. Resources and manpower of the country

    b. Research and extension organizations

    c. Backlog of agricultural research

    d. Severity of problems and conditions

3. Therefore, approach to FSR needs to be flexible and the methods of evaluation likewise.

THE ICTA CASE

Overview of ICTA Program
DSB-USDA Symposium on
Farming Systems Research

ASTOLFO FUMAGALLI C.
Washington, D.C.
Dic. 1980

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THE ICTA PROGRAM

The Institute of Agricultural Science and Technology known in Guatemala as ICTA is a part of the Guatemalan Agricultural Public Sector which was reorganized in 1970. The reorganization of the Ministry of Agriculture sought to revitalize the agricultural public sector in view of the increasing demands for food grains.

two principal goals were set:

- First: To increase food production, specially the basic food grains (corn, beans, rice, wheat and sorghum).
- Second: To stimulate rural development, the small and medium size farmers were the main target group.

the major changes were:

1. The establishment of INDECA as a decentralized marketing institute with the main purpose of establish food grain prices.

2. The reorganization of the Governmental Agricultural Credit in one Institution or Bank (BANDESA).

3. Reorganization of the General Services of the Ministry of Agriculture (DIGESA), which is the non-decentralized operating arm of the Ministry.

INDECA and BANDESA were decentralized with the Minister of Agriculture chairman of both the boards of directors.

the general services includes the divisions of:

1. Development. This division includes the supervised credit programs, with funds furnished by BANDESA, the National Agriculture Bank.

2. Training and Education. This division includes the extensive service and a Secondary Vocational Agriculture School.

3. Natural Resources. Mainly dedicated to the study and construction of small irrigation projects.

4. Research. This division was a traditional research program, working on many crops. It was the basis for the creation of ICTA.

Foundation of ICTA

The idea to decentralize research into a new and autonomous institution was formulated in October of 1970, at the time the reorganization of the Ministry was taken place. The Guatemalan Government through the Ministry of Agriculture sought the collaboration of the Rockefeller Foundation and USAID to establish a Research Institute with strong linkages to the International Centers; CIMMYT, CIAT and CIP. Under the sponsorship of the Rockefeller Foundation and the USAID several work groups were formed through a period of two years. Many scientists from Latin America, the USA and Guatemala participated with their ideas and experiences. And little by little the objectives, phylosophy and the strategy of the new Institute were taking form in the planning documents. In May of 1973, the Institute of Agricultural Science and Technology, known through all Guatemala as ICTA, was born. We have to give our thanks to many people who gave us their time and talents, but a special mention should be done to CIAT who was with us since the beginning.

The responsabilities of ICTA are set forth in Congressional Law (Decree 68-72) which established the Institute to develop technology and promote its use for the wellbeing of the population. A summary of the objectives stated in the article 3 of the ICTA's Law are as follows:

ARTICLE 3:

1. ICTA is the Governmental Institution responsible for generating and promoting the use of science and technology within the agricultural sector.

2. Therefore, it is ICTA's concern to conduct research focused on the solution of problems of the agriculture of the country in order to improve the wellbeing of the population.

3. It falls to ICTA to produce materials and determine methods to increase agriculture production.

4. ICTA should promote the use of technology.

5. ICTA should promote regional rural development.

- The working structure of ICTA is a very simple one. There is a Board of Directors. The Minister of Agriculture is the President and Directors are the General Secretary of National Planning, the Minister of Economy or his personal representative, the Minister of Financing or his personal representative, the Dean of Agriculture of San Carlos University and one citizen at large named by the other members of the board. In addition, the heads of the Public Agriculture Sector are permanent advisers to the board, and are usually invited to sessions of the board, which meets about once a month. The programs and functions of the Institute are directed by a General Manager along with an Associate Manage r.

there are three working units:

1. Unit for Administrative and Financial Services.
2. Unit for Programing.
3. Technical Unit for production.

The terminology was specifically selected believing that the Administrative Unit should be a service to help programs and not run the Institute, and that the Technical Unit should give emphasis to impact production and productivity and that research results should not be considered the final product.

The technical unit for production is the heart of the Institute, and is headed by a Technical Director. The groups within this unit are:

1. National Commodity Programs which are principally research programs responsible for the identification, generation, adaptation and initial testing and technical evaluation of technologies.

these national commodity programs are:

a) Maize (corn)
b) Beans
c) Wheat
d) Rice
e) Sorghum
f) Horticulture
g) Sesame
h) Cattle

2. Suport disciplines. Areas of work which are important and commonly to all the commodity programs; these are:

a) Socioeconomics.
b) Validation of technology.
c) Soil management.
d) Service Training.

3. Technical service groups.

a) Production Centers (Experimental Stations).
b) Communication (Publication and Documentation).
c) Soil Laboratory Analysis.
d) Seed Production.

<u>FARM SYSTEM RESEARCH AT ICTA</u>.

Since the beginning ICTA had a direct responsability for the creation and identification of technology, testing it under conditions where it is gone to be used and adapting it to the conditions of the user: the small and medium size farmers.

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ICTA also has the responsability to transfer the adapted technology among the target group. For being able to do all of these it was necessary to know which were the deficiencies of the traditional research system used in the past. We believe that the traditional research system failed because:

1. The researcher has not considerate the problems of the small farmer and his systems of farming.

2. The researcher has not tested the technology at the farm level, under conditions of the small farmer, because he has not mastered his system and has not felt the responsability to do so.

3. Acceptance by the small farmer has not been a part of the evaluation of the technology.

In order to correct these deficiencies a new system was set up, where the farmer is a very important member of the research team, where he is an active member not a passive one expecting only to receive advis when perhaps it is not needed or it is not wanted nor useful. In thi system demonstration plots were forbiden and instead Farmer's test were adopted.

The Farmer's test, which are planted by the farmer, taken care by the farmer and harvested by the farmer, and, we get at the end his opinion which is very important to the evaluation of the technology and is the beginning of a true transfer of technology. But something was missing to get a true understanding of our clients. It was then when we agronomists started looking for help and we found it in the social sciences. The interest of ICTA in the social sciences was based on their possible contribution to the efficiency and effectiveness of agriculture production. We asked to our socio-economic group, which by the way, was the last one to be formed at ICTA, to focus their interest on:

1. The micro economics of the systems presently in use by the small farmers.

2. An analytic function to assure that the recommended practices are economically favorable for the farmer.

3. Detecting and identifying the desires and needs of the small farmers with the objective in mind of making the research more efficient and then the transfer of technology to the farmers more effective.

4. Contributing to the feedback of information from the field to the commodity programs and to the administration.

5. Participating in the evaluation of the institutional projects.

We did not have an instant success, it was necessary to make many changes along the way. One thing was important, the collaboration of the commodity programs and the other disciplines integrated into Regional Teams. For instance, in this way it was found that the commodity programs started producing better materials such as new varieties of the crops under the responsability of ICTA. It was found that the acceptance of such new varieties by small farmers was more easier. But this acceptance was not only because the varieties were good, it was because the farmers knew that the varieties were good and they knew it because they helped to develop them.

THE ROLE OF GOVERNMENT.

The Guatemalan government at the time of the creation of ICTA was aware of the potential benefits of a successful program for small farmers were many, and actions were taken to reorganize the Agricultural Sector of the Government. The Government invested time and money to change the old structures for new ones. Now ten years later, we believe that such efforts were worthwhile in some areas and in others were not. At the beginning the moral and financial support were great. As it was mentioned earlier research received a special treatment. The budget for research was not a big one but was enough. ICTA received the governmental support to make agreements with the International Centers, Foundations and other governments. ICTA put in motion the bigest scientific training program for agricultural personnel in the guatemalan history.

Today the government is still supporting the ICTA program, but due to the problems caused by the inflation in the whole world, the budget seems smaller than ever. Many well-trained guatemalan scientists are moving to other possitions in other governmental programs or to the private sector where they get a better payment. ICTA is still working and is doing it's job, and it is a remarkable good one, but for sure needs more governmental help. It is necessary to reinforce the budget and restablish again the scientific training in its graduate level. It is necessary to strengthen the linkages with the international centers.

WHAT ICTA HAS ACCOMPLISHED.

Agricultural conditions vary widely in Guatemala and so do agronomic practices. Therefore, no attempt shall be made to present in this section what ICTA has accomplished under such varied conditions; rather, a few examples will suffice to illustrate ICTA's main achievements.

a) ICTA has contributed to creating new dimensions of managing agricultural technology, from the initial scientific stages to the technological stage at farm level. The technological system devised by ICTA has proved its value working under diverse conditions in Guatemala and is carried out as a joint effort of commodity programs, disciplines and technical services, working as multidisciplinary regional teams.

b) Considerable progress has been accomplished in the making of superior new hybrids and varieties of basic grain crops, that have been bred for resistance to diseases, high yields and higher nutritive value. Four new hybrids and two varieties of corn yielding over four metric tons/ha, average of three years at 80 locations in farmer fields, excellent plant type, good husk coverage and lodging resistant are now in commercial use for the coastel area, considered the bread basket of the country. The impact on corn production of these new genotypes has been estimated at about 1.4 metric tons per

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hectare. Likewise, for the Altiplano five new varieties developed from local and improved germplasm have been developed or improved that are well adapted to specific site conditions. Farm trials conducted during 1978 and 1979 at 40 locations showed a 25% yield increase over the yield of the best criollo.

Also, corn growing formulas for the Valley of Quetzaltenango and Totonicapan, giving the most adequate time of fertilizer application and plant densities has been developed. However, due to the fact that many criollo varieties are good yielding and that farmers keep their own seed from one year to the next, acceptance of new improved varieties has been only about 16%. On the other hand, acceptance of fertilization practices for corn has been nearly 80%. Of special significance is the recent development of a new flint type corn, NUTRICTA, bearing the gene OPAQUE 2, with yields at experimental level at San Jerónimo, Baja Verapáz, of 7.9 metric tons per hectare. We have to see yet how is going to be the acceptance by the farmers. Wheat and potatoes are important crops in this region also, and a sound program is in effect to develop disease resistant varieties of these two crops. Acceptance of improved varieties of wheat has been 100%, due to their excellent plant type and their high disease resistance and superior yields.

The potatoe program has developed three new virus-free potatoe varieties yielding well over 18 metric tons/ha. Seed of these new varieties will replace farmers's stocks that are actually 70% infected with several different kind of viruses.

In cooperation with the Regional Cooperative Potatoe Program, PRECODEPA, two very efficient structures for commercial and seed potatoe storage have been designed and tested. In this Regional Cooperative Program are participating the following countries: México, El Salvador, Honduras, Costa Rica, Panamá and the Dominican Republic under the leadership of the Potatoe International Center.

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These structures that can be built with local materials at a very low cost will enable the small producers to double their income by selling their product after two or three months storage with only 3% losses due to rotting and dehydration; it will also alleviate the need for a dependable source of good seed.

For the eastern part of the country where beans are an important crop three new varieties highly tolerant to the dreadful Yellow Mosaic Virus disease, have a yield potential of about 10 times the yield of the susceptible Rabia de Gato variety that yields only 280 kg/ha when climatic conditions favor the development of yellow mosaic. In addition, chemical control methods for this disease have been developed: IÇTA JUTIAPAN a new tolerant variety yielded 3,443 and 2,133 kg/ha (38% loss) with and without soil treatment at planting time with Furadán 5% at the rate of 20 kg/ha plus five foliar applications of Tamarón 600 at weekly intervals, while Rabia de Gato, the criollo variety yielded 1.960 kg/ha when treated and 280 kg/ha (86% loss) when not treated, at Jutiapa, Guatemala.

Also, four new genotypes adaptable to the central highlands are being increased for distribution to farmers for their high tolerance to diseases and high yields.

Rice is also an important staple food and efforts to increase production on the Pacific and Atlantic coast were greatly enhanced when TIKAL 2, a new blast disease resistant variety was released. During 1979, about 70% of the area on rice in Guatemala was planted with this variety and two new varieties will soon replace TIKAL 2, that has become susceptible to Pyricularia.

On the Atlantic coast fertilizer trials with rice demonstrated the importance of phosphorus applications to raise rice yields to a commercial level. Rice plots with adequate levels of nitrogen and calcium but with phosphorus lacking gave only 1 metric ton/ha in comparison to 4.5 metric tons/ha when this element was added.

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On sorghum two new hybrids and one variety suitable for human consumption have been developed by ICTA with yields of four tons/ha, while the local criollo yields only 1 ton/ha.

For the Northeastern part of the country, ICTA has not only demonstrated the value of new crop introductions and developed modern ways to grow them profitable, but also has gone one step further explorin international markets for export. Based on ICTA's experiences, 70 growers of three cooperatives have themselves exported their own pro duce since 1977 for three consecutive years. Their exports have totalled well over two million dollars.

c) The strategies worked out by ICTA for making available to farmers seeds of the new varieties have also proven successful. Three years after ICTA started operations only 136 metric tons of seed were sold out of 300 produced, while in 1977, 1978 and 1979 all the seed was sold. In 1980, ICTA and the private seed growers sold abou 1,200 metric tons and estimates for the coming year indicate that 3,000 metric tons of ICTA seed will be on the market. The scheme relies on having seed growers make free use of foundation seed at reasonable prices, the creation of price incentives and also access to the physical facilities at Bárcena for processing and storage of seed.

d) The establishment of inter-institutional courses of 10 months duration between ICTA and other agencies, mainly DIGESA, for the purpose of making them throughly familiar with ICTA technology at the Farm trials and Farmer's Tests, has proven to be a sound measure to close the gap between research and extension. Three of these courses have been offered in three different regions and although no evaluation of results has been made so far, it shows promise of being an excellent approach for transfering technology to farmers.

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In concluding, I must say that the ICTA experience has been one of the most successful and rewarding efforts ever made for the purpose of developing a workable system for the generation and validation of technology for subsistance farmers.

It has also shown the invaluable scientific and technical aid and otherwise that concerted action between international centers, universities and international and regional agencies can bring about for the purpose of solving the many problems that afflict agriculture in many parts of the world today.

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FARMING SYSTEMS RESEARCH
IN GUATEMALA

Ramiro Ortiz Dardón

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FARMING SYSTEMS RESEARCH IN GUATEMALA

Ramiro Ortiz Dardón*

INTRODUCTION

Technology generation alone, should not be the ultimate objective of a national agricultural research program. Only when the technology is being widely used by farmers has the objective been reached and the researcher accomplished his mission. This is the challenge that a new breed of technicians in many developing countries of the world is accepting. These are the technicians who are solving crop and animal production problems for small, limited resource farmers, who in turn, comprise the largest proportion of farmers in most countries but for whom little has been accomplished heretofore.

The Institute of Agricultural Science and Technology (ICTA) in Guatemala is an example of the above. Since its origin in 1973, ICTA has been developing a series of strategies to generate and promote the use of technology in a systematic approach, appropriate to the interests and needs of the small farmers of the country. This approach is the result of contributions of many people based upon many years of experience and combined with participation of institutions, international centers and government's true concern for developing an effective national program. It is also the result of young technicians working in the field with a striving desire to succeed in generating a technology that will soon be adopted by most farmers. The more relevant aspects of this new approach for ICTA's Farming Systems Research program are the following:

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*Formely Technical Director, ICTA, Guatemala. Presently Research Assistant, Agronomy Department, University of Florida.

1. A thorough knowledge of the agro-socioeconomic conditions of the farmers in a region is required and is achieved by integrating biological and social scientists who together identify farmers resource, constraints, and other problems in order to design and conduct "reality-oriented" projects.
2. Most research is moved off experiment stations to farms where it is conducted under the farmers' conditions. This has brought reliability to the results since they capture the variation throughout a region.
3. The involvement of the farmer in the research process from the beginning, giving him the main role in the final stages of evaluation of the new technology. This is perhaps the major and most important change from the traditional approach.
4. Extension agents are not only considered an excellent contact when first arriving in a region, they can and have participated in surveying the region to determine what the research priorities should be. They also participated in research projects by conducting a portion of the trials before transferring results to the farmers. The purpose of this has been for them to know the "why's" and the "how's" technology is generated, "getting the results first hand", and it has made them feel more motivated to do their work; thus, the gap between research and extension is closed.
5. Research programs are not committing themselves only to the extension service, they are also establishing close linkages with organized groups in the rural areas (cooperatives, farmers informal groups, etc.) and the private sector.

The objective of this paper is to provide information about the organization and objectives of ICTA, and to describe the most important aspects of its agricultural technological system.

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THE NEED FOR A FARMING SYSTEMS PROGRAM

Historically, national agricultural research programs have been oriented toward the solution of the problems of commercial agriculture[1/] under the assumption that the production technology designed for this type of agriculture would be adopted with equal success by limited resource farmers in traditional or subsistence agriculture.[2/] This assumption has not been proven correct because, in most cases, the technology generated for commercial agriculture has strongly clashed with the traditions of the small farmer. The reasons for this are, 1) this technology is not compatible with the resources and the production systems that are prevalent in subsistence farming, and 2) the risk associated with this technology is too high and does not offer a sufficient increase in income to offset the investment.

In trying to design a program to generate and promote the use of technology appropriate to needs and incomes of small and medium farmers, the deficiences of traditional research and extension systems were studied in Guatemala (Waugh, 1975). Through the study of systems used in other countries it was hoped a research and promotion model could be designed that would correct the deficiencies identified in the models that failed. It was established that research for traditional agriculture had failed mainly due to 1) the researcher does not know the problems of the farmers nor his production systems, 2) the

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[1/] Laird (1977), defines commercial agriculture as that practiced by farmers that have medium or large holdings, who use modern technology and mainly produce for the market, and they receive medium or high agricultural incomes.

[2/] Laird (1977), defines this as being practiced by farmers with small land holdings, who make only very limited use of modern technologies, who consume a major part of their production on their own farm, and receive agricultural incomes that are very low. They are characterized by lower levels of productivity, and more labor and high levels of seasonal unemployment. Most traditional agriculture is practiced under unfavorable ecological conditions that limit productivity.

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technology that is generated is not tested at the farm level, and 3) the acceptability of the technology to the farmers is not evaluated. Generating technology was the first step in the strategy to increase production through an increase in productivity, but this first step had to be backed up by the knoweldge that this technology would reach the clients. It was because of this that in the model designed for ICTA, the component of promotion of the use of technology had to be included. The deficiencies in the traditional extension system, which until that time had also been a failure, were identified as 1) an appropriate technology is not available, 2) the technology generated is not tested before recommending it, 3) there has been a loss of contact with the researcher, 4) the technology of the farmer is unknown, and 5) an effective extension evaluation system does not exist.

Through this study of the deficiencies in the systems of traditional research and extension, it was determined that the interrelation farmer-extensionist-researcher is indispensable in planning and conducting a program of technology generation and validation that is applicable to the needs of the farmers of a region. This relationship is also necessary to insure an effective transfer process of this same technology. In the design of ICTA it was considered that the objective should not be only to generate technology. Rather, the technology should serve as an instrument to increase productivity and to improve farmers' incomes.

FUNCTIONS AND OBJECTIVES OF ICTA

ICTA was established May 10, 1973. The specific objectives and its functions are clearly defined in article number 3 of its organic law (legislative decree #68-72). The Institute of Agricultural Science and Technology is responsible for generating and promoting the use of agricultural science and technology in the agricultural public sector. As a consequence it has the responsibility to conduct research pertinent to the solution of problems of rational agricultural exploitation that influence social well-being; to produce materials and methods that increase agricultural productivity; and to promote the use of technology at the farmer and regional levels. Since the emphasis is directed to increase the production of basic grains, the main group who benefit are the small and medium farmers who produce almost all of these crops. This in no way means that commercial agricultural is excluded since much of the technology generated by ICTA should be applicable to their conditions also.

Even though the main responsibility of ICTA was to increase production, there was also an interest in the well-being of the rural population. In accordance to the characteristics of this population the logical strategy to reach the general objective was to generate technology that was economically favorable. In this way, the production of food would be increased and this in turn, would be the economic base to achieve development.

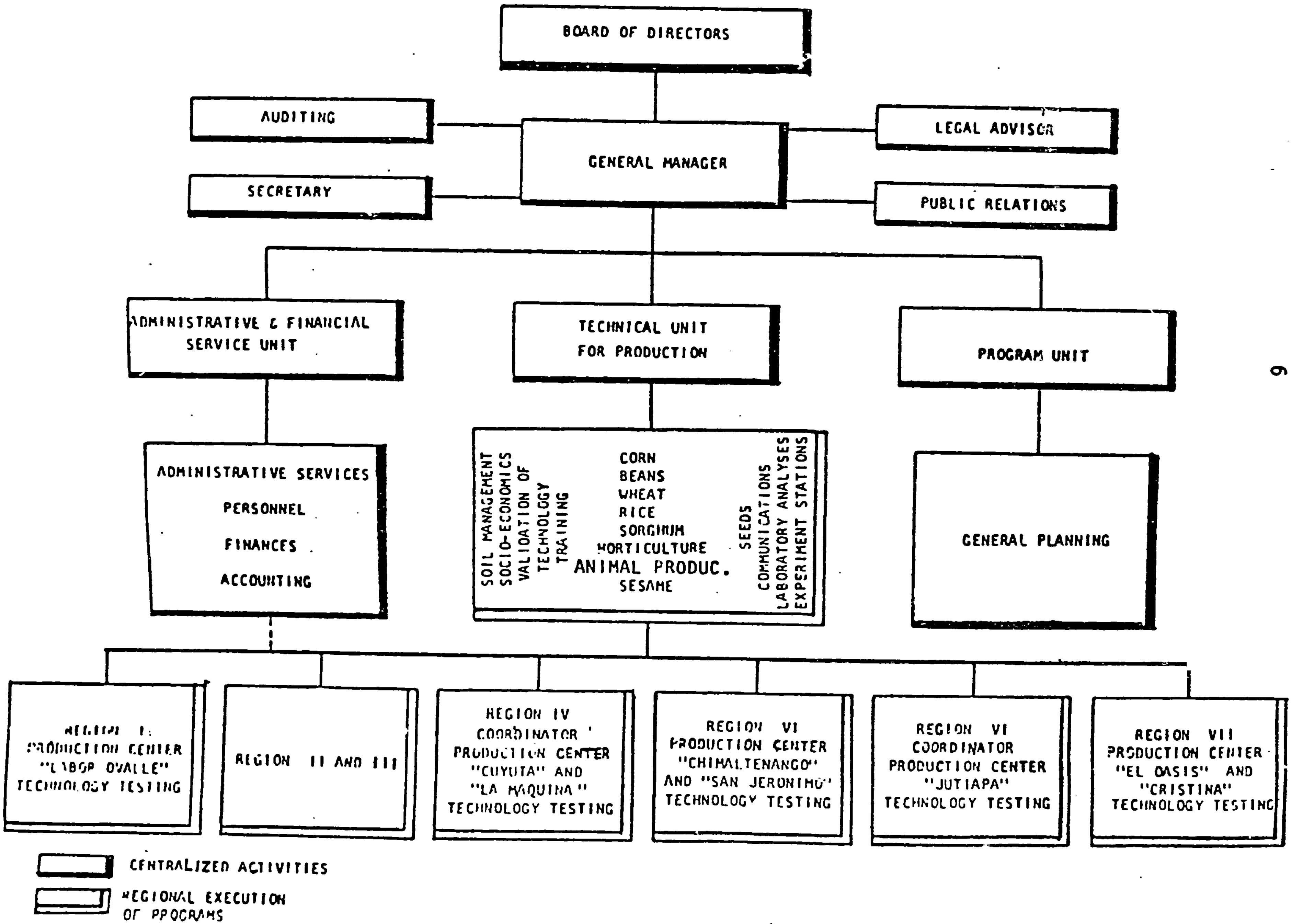
ORGANIZATION OF ICTA

Using as a guide the law which created ICTA, it was decided to create a structure that was very simple. This simple structure is shown in figure 1.

Board of Directors. This is the highest authority in the Institute and besides its President, who is the Minister of Agriculture, it is formed by the Ministers of Economy and Finance, the Secretary General of Economic Planning, the Dean of the Faculty of Agronomy of the University of San Carlos and a representative of the private sector.

ORGANIZATION OF ICTA

Figure



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General Manager. The General Manager, representative of the Board of Directors, is responsible for achieving the functions of ICTA and directing the work plan jointly with the Deputy General Manager. The General Manager presents the work plan and the budget to the board of Directors and interprets public policy to the work teams of ICTA. For the executive of its functions, ICTA has three units: 1) the administrative and financial service unit, 2) the program unit and 3) a technical unit of production.

TECHNICAL UNIT OF PRODUCTION

This unit is headed by the Technical Director whose principal act is coordination of all research activities including testing and transfering technology. The Technical Director has consultants who are the Coordinators of Programs and the Support Disciplines. This group is called Technical Coordination. The groups within the technical unit are the following:

1) Production programs. These are national research programs for each crop or product. Their work mainly involves the initial stages of research, i.e., identifying, generating, adaptation and the tests which are preliminary to new technologies. The production programs of ICTA are the following: corn, beans, wheat, rice, sorghum, vegetables, sesame seed, animal production and fruits.

2) Support disciplines. These are groups which support the production programs and the regional teams. The majority of the technical personnel in the different disciplines is assigned to the regional teams. The Support Disciplines are Technology Testing,[1] Rural Socioeconomics, In-Service Training and Soil Management.

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[1] The true name of this discipline is technology testing and transfer. The discipline works in groups as teams which form the regional team. Since a regrion is very big there is a need for a team in order to take care of it. The Coordinator of these groups at the regional level is the Regional Director. The national coordinator of these groups is the Technical Director.

3) Technical services. These groups provide service to the Production Programs and Regional Teams. They comprise the following areas: Seeds, Communications, Soil Laboratory and the Production Centers.

4) Regional teams. These are groups formed of multidisciplinary technical personnel. All the personnel who are assigned to a region, whether in Production Programs, Support Disciplines, or In-service Training groups, are all part of the regional team. This means that a technician can be assigned to a regional team and at the same time be part of a program or discipline. The regional team is managed by the Regional Director, the maximum authority of the Institute within the region, who as the representative of the General Manager and the Technical Director, is responsible for the coordination of all activities of the Institute in the region.

All the groups in the Technical Production unit coordinates activities based on a technological system (Waugh, 1977). ICTA has developed a research model based on a series of strategies which are mainly directed to eliminate the deficiencies of the traditional research and extension systems. Fumagalli and Waugh (1977) call this series of strategies "A Technical System for Production" or an "Agricultural Technological System".

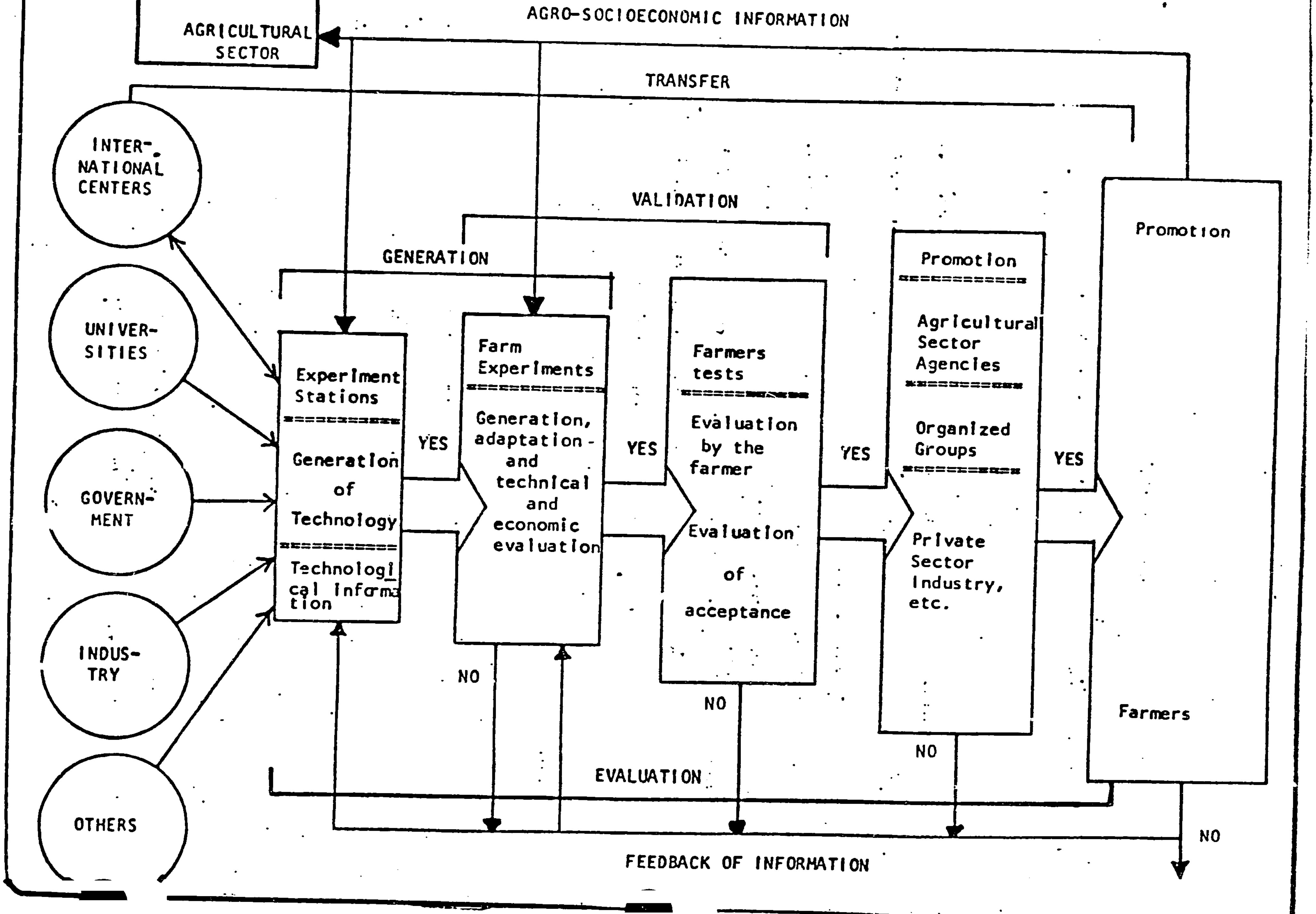
AGRICULTURAL TECHNOLOGICAL SYSTEM

The operational flow chart shown in Figure 2 represents the Agricultural Technological System. The technological system is continuous even though it is shown and discussed in parts. The process does not necessarily move from left to right. The most logical place to start is in the last block to the right with the gathering of agrosocioeconomic information.

The tools used by ICTA are the identification of the agrosocioeconomic characteristics of the region through a sondeo; research results from experiment stations and farms; and the results of the evaluation of acceptability

Figure 2

TECHNOLOGICAL SYSTEM FOR AGRICULTURE



of technology. These are used in planning a regional program adapted to the necessities of the farmers that live in the region. Perhaps the most important characteristic of the regional teams is the fact that the members of the regional team participate in and define their own work priorities. With the multidisciplinary approach they work and live with the farmers of the region, getting to know the different production systems and management practices. It is the type of activities conducted by the Regional Teams and the way in which they do it, that provides this team with an ample and objective experience concerning the prevailing conditions. This has determined that the members of this team, guided by the Regional Director and supported by a group with recognized scientific and technological capacity (Technical Director and Technical Coordinators) have the responsibility of defining the priorities of agricultural research for the region within the context of the functions and the objectives of ICTA and also of the national development plan. The main components of this system are here described:

Identifying the Problems

When a new work area is determined, the first activity is a reconnaissance through a methodolgoy called "sondeo" (Hildebrand, 1979). This is a type of modified survey developed by ICTA to provide information to be used as a basis for guiding the work of the regional ICTA team. The objectives of this reconnaissance are to identify a group of farmers that are "homogeneous" in the characteristics of the production systems and their traditional production technology and define the limits of the area within which this group is a main component of the population. The identification of the prevalent production system and of a group of farmers who use the system have been grouped through a natural selection process, responding in a similar way to common limiting factors (Hildebrand, 1979). The Sondeo is carried out by a multidisciplinary team comprised of the Technology Testing Team that will develop the research program in the area and technicians from the Discipline of Socioeconomics. Occasionally, technicians from the Productions Programs of ICTA or agronomists of DIGESA have participated in the Sondeo.

The Sondeo methodology, developed by the discipline of Rural Socioeconomics of ICTA, was designed in response to budget restrictions and time requirements as an efficient methodology for obtaining the agrosocioeconomic information in a region where the generation and promotion of technology is to be started (Hildebrand, 1979). This methodology gives the team in ICTA qualitative information about a new area that is sufficient for planning and implementing the activities for the first year. Nevertheless for following years it is necessary to have quantitative information to orient or guide research. After the second year, this information is available from the research results of the first year, the farm records and the evaluation of acceptability of technology.

Generation of Technology

ICTA bases its technology generation approach on an understanding of the production systems of the farmers and the management given them. The farmer has, through the years, designed a technology that is a function of his resources and his perception of the risk that exists given the conditions that surround his production system. It is expected that when the technician knows all the characteristics of a specific system he can identify some modifications that could produce an increase in profitability. Therefore rather than design "technological packages", ICTA has developed simple technological production alternatives that farmers evaluate and select according to their own criteria.

It is very important to use all the resources that are available to initiate this research program. Many of these resources, that form technological support in Figure 2 , are outside institutions. Such resources are materials, methodology and technologies in general which are developed in international centers, universities, and other governments and national research programs, industry (fertilizers, seeds, herbicides, etc.) and others.

Research planning is the most important activity of the regional teams of ICTA during the year. It requires a week in the region to present the results of research, what has been accumulated through the farm records, the evaluation of acceptability of technology, and the conclusions of Sondeos that have been done in new areas within the region. In these meetings, that are presided over by the Regional Director and in which the Technical Director and members of Technical Coordination take part, the results are discussed widely, in depth and objectively trying to reach conclusions that are in agreement with the actual situation that is presented. This regional Operational Plan is the work which the regional team will do for the following year.

On the basis of the regional operational plan, the team carries out technology generation on the production centers (experiment stations) and on farms. The tests are called "experiment" if done on a production center and "farm trial" if conducted on a farm. This distinction has been very useful to identify where activities are located. Today around 90% of the resources are directed into working on farms. The production centers are mainly used for work that requires controlled conditions (crosses, early generations of new materials); for the evaluation of germ plasm when the reaction under local conditions is unknown; and to evaluate a new practice that can be very risky and could result in a loss in the crop of a farmer, such as tests with herbicides.

The main objective in the design of all farm trials in ICTA is obtaining realistic results for technology design that reflect the conditions of the farmers and result in substantial increases in productivity and/or profitability of the production system. The design of this appropriate technology is based on the concept that one must achieve maximum efficiency in the use of resources that are available to the farmers or that they can easily obtain.

Technology Testing and Evaluation of Acceptability

Without taking away the importance of the other aspects of the technological system of ICTA, this component without a doubt is the most important. It is here where the results of the technology generation process, the production alternatives, receive their test "under fire" when they are managed completely by the farmer. Up to this point it has been the technician who has evaluated the technology based on statistically reliable research results. Ultimately, it will be the farmer who will decide if the generated technology is relevant to his production system based on his own choice criteria.

The test of the generated technology is done through the "Farmer's Test", which consists in using the technological alternatives developed by ICTA on part of his land. The technician of ICTA acts as an advisor, orienting, and being a friend of the farmer during this evaluation process. But it is the farmer who will manage the test, during all its phases so he really gets to know the new technology. This knowledge will allow him to decide for himself if the technology is applicable to his crops and if it pays for the resources used and if the technology translates into some increase in his yields and profits.

The Farmer's Test is the way to put technology in the hands of farmers for their evaluation without exposing the farmer to too much risk, since the technology has been evaluated technically and economically on farms by the ICTA teams. It is important that the farmer, besides providing the land, also pays for all the expenses of the test. This is done to assure the farmer's interest so that he will know all that is involved during the test and will give as much attention to it as he does to the rest of his farm.

The evaluation of acceptability of the technology tested by the farmer is done in the following agricultural cycle. The farmer, who, investing his resources and his work, conducted the farmer's test, had the opportunity to observe how the technological alternatives worked and decide which ones to integrate in the management practices of his system.

The technical team of the Discipline of Rural Socioeconomics conducts the evaluation with the assistance of the Technology Testing Team of the area. These technicians determine the acceptability index (A.I.) of a technological alternative by identifying the farmers that adopted the alternative and the proportion of their crop in which they applied it. Therefore the A.I. measures the active acceptability of technology (from those farmers who tested it the previous year) and is calculated as follows:

Acceptability Index = (%of the farmers that used the practice) x (% of the area of the crop in which the practice was used) / 100

Besides determining the A.I. the ICTA team identifies the causes of adopting or rejecting the new technology. The A.I. helps the regional team determine if they should promote the use of technology. If it has not been accepted but has technical and scientific merit and is promising, they feedback the reasons of non acceptance. With this information the researchers modify the design so it will better fit the demands of the farmers and gain acceptability.

Promotion and Transfer of Technology

Since the results of research are not the final ICTA product and because ICTA is responsible for promoting the use of the technology that has been generated, there must be a mechanism to make the transfer process more fluid. ICTA has focused the promotion of technology towards the public agricultural sector, organized groups and the private sector:

1. ICTA considers its main client to be the "promoters" of the General Directorate of Agricultural Services (DIGESA). DIGESA is an institution responsible for transferring technology generated by ICTA for the farmer. The communication between these two institutions has been strengthened progressively, especially after the formation of the Regional Agricultural Development Committees (COREDA). It is in these COREDA that the representatives of ICTA and DIGESA discuss, at the regional level, the procedures and mechanisms that will be used to achieve an efficient transfer of technology generated by ICTA. Through the COREDAS an in-service training course has been institutionalized in transfer of technology for the "promoters". The main objective of this course, which takes a whole agricultural cycle, is to give to the promoters the technology that ICTA has generated and validated. They, in turn, pass it on to the farmers on a large scale through technical assistance. In these courses, which are specific for each agroeconomic region, the DIGESA "promoters" dedicate one day a week to participate in conferences, seminars agricultural encounters,[1] and field days. This type of activity conditions

[1]This is an activity developed in a farmer's field where the group defines and solves specific problems.

them to increase their knowledge of agricultural topics and improve verbal communication. In addition, they are responsible for working in a "teaching plot" to develop their capacity as agronomists and to understand better why they use certain practices. In other words, they have more contact with day to day reality, at the same time, they must conduct Farm Trials, Farmers Tests, and Commercial Trials [1/] with farmers working next to them. This is an efficient transfer mechanism. In general terms it has been proven that these courses improve the technical capacity of the promoters and it makes transfer activities much more effective when the "promoters" get to know the system that generated the technology.

2. ICTA realizes that the services of the public sector will hardly benefit all farmers, so it is working with private organizations hoping that through them the technology will reach the farmers. The process has consisted of signing letters of understanding with organized groups to formalize projects with the objective of promoting the use of the better technology. In this case ICTA assigns a technician who, besides working in technology generation and testing, trains and advises selected farmers to conduct Farmers' Tests, and Commercial Tests on the land of other members of the organized group. This creates a multiplier effect by directing the technicians activities towards a whole group with the same resources that were going before to help more isolated farmers.

3. The private sector has a very important role in the process of agricultural technification. Much of ICTA's technology depends on the participation of the private industry. Its contribution radiates in a series of

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[1/] The technological alternatives are put into practice with the appropriate use of technical assistance services and credit.

services through which the farmers obtain inputs such as fertilizer, seeds, herbicides, etc. It is hoped that the collaboration of the private sector will be to have inputs available at the right time with the correct instructions for their use.

The most interesting case of how the private sector has been incorporated in the transfer of technology is in the development of the seed industry in Guatemala. This phenomenon is the result of the application of a strategy of incentive used by ICTA who, through a series of mechanisms, has been able to intervene in the private sector in the production and commercialization of better seeds of basic grains (Ortíz, 1980).

The results of this strategy has been extraordinary. At the present time all improved corn seed for the Guatemalan lowlands is composed of ICTA materials. This can be compared to 1977 when ICTA materials contributed less than 10% of the necessities of this seed and ICTA produced 60% of this amount (Ortíz, 1980).

SUMMARY

ICTA does not consider itself only an institution of research. Neither does it believe that research results are the final product; instead, it has considered that the appropriate objective is that technology be widely used by farmers. With this belief it has developed a practical approach based on the needs and characteristics of the rural population of Guatemalan and through its application has taken the first steps toward identifying the solutions to farming systems problems in this country.

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STAFFING AND FUNDING IN THE INSTITUTO DE CIENCIA Y TECNOLOGIA AGRICOLA (ICTA)[1/]

INTRODUCTION

There are documented references to different aspects of staffing in ICTA but to my knowledge there have been no specific studies made on the character and needs of staff of the Institute. Likewise, to my knowledge, there have been no detailed and specific studies of costs of FSR within ICTA except those related to the general procedures of budget requests and budget management. Also the on-farm (FSR) research in ICTA is combined with other kinds of technological activities such as commodity (maize for example) and discipline research (soils for example). In addition there are "service" groups such as Seed and Training functioning in ICTA. While all of these activities, in some maner, are directly related to the on-farm (FSR) objectives the total cost of ICTA does not indicate costs of the FSR component within the Institute. (1) (2).

STAFFING

OVERALL STAFFING

The overall institutional professional and sub-professional staffing for the years 1973-1979, excepting foreign personnel, is shown in Table 1. The foreign staff are shown in Graph I. These data of Table I include only personnel with university and high school equivalent education. Some of the secretarys, and almost all of the security guards, drivers and other service personnel are not included. Total staff named to regular positions was 343 in 1978. Thus the data given in Table 1 are estimated at 70 percent of the total regular staff. In addition there were (1978) about 500 laborers. Of the sub-professional staff about one-half were Peritos Agrónomos working in research and most of the remainder were secretarys, accounting personnel, etc. working in administration.

1/ Prepared by Robert K. Waugh, member of the Rockefeller Foundation, Resident Scientist of IICA in Honduras, assigned to the Secretaría de Recursos Naturales as Research Policy and Management Advisor, for a symposium on farming systems research organized by the Office of International Cooperation and Development of the USDA, December 8-9, 1980, Washington, D.C.

PROFESSIONAL AND SUB-PROFESSIONAL PERSONNEL BY YEARS (1)

PROFESSIONAL	1973	1974	1975	1976	1977	1978	1979 (5)
1. Ph D	1	1	1	1	1	2	1
2. M.S.	6	8	10	9	9	8	10
3. University Graduate	27	37	51	52	63	62	60
4. University (without thesis)	8	14	16	32	55	58	60 (4)
5. Total Professional	42	60	78	94	128	129	131
SUB-PROFESSIONAL (3)							
6. Peritos and Equivalent	47	67	86	113	113	116	178
7. TOTAL	89	127	164	207	241	245 (2)	
% University personnel	47	47	48	45	53	53	

(1) ICTA Program Unit February 7, 1978
(Foreign personnel not included)

(2) Of this group 66 were administrative and 26 technical staff assigned to the central office. The total staff named to regular positions was 343. The number of laborers, permanent and temporary averages about 500.

(3) Includes secretarys with high school equivalent.

(4) Includes 10 1ast year agronomy students from the University of San Carlos in the agronomic training course. About 1/2 of their time was dedicated to institutional work.

(5) Information for 1979 furnished by the personnel office of ICTA, May 10 1979, six years following the inauguration of the Institute.

(6) This figure apparently caculated different than for previous years.

GRAPH I. FOREIGN [illegible] ONAL - ICTA [1/]

Years: 73, 74, 75, 76, 77, 78, 79, 80

Area of Work	Est Man Months
1. Adjunct Director	75
2. Technical Director	71
3. Sorghum	78
4. Field Research (on farm)	30
5. Horticulture	60
6. Beans	82
7. Maize	86
8. Irrigation	24
9. Training	30
10. Seed	30
11. Exp. Stations	60
12. Socio-economics	51
13. Sociology	30
14. Farm Systems	30
15. Grupo Taiwan	312

1/ This graph made from approximate information. Estimated total man months, excluding Taiwanese 737, over a period of approximately 7 years

Over-all staff increased steadily from 1973 through 1977, with a 275 percent increase in professional and sub-professional staff in 1977 as compared to 1973, this latter being the year that the Institute was organized (end of year data). The increase in university graduates over the same period was 300 percent. Then growth stagnated.

This increase in personnel was parallel with an expansion in research, both on-farm and commodity and discipline. There was an attempt to keep a good balance between commodity and discipline research and on-farm research. However staff increase and development probably favored the commodity programs during the first couple of years and after that the on-farm activities.

DEVELOPMENT OF ON-FARM TEAMS AND THEIR PERSONNEL

On-farm research was started in 1973, and the effort was largely directed to screening of available technology. Most of the work was done by personnel of the commodity teams, although some personnel worked directly under the ~~direction~~ supervision of the technical director without being assigned to a commodity group. Most of the personnel were agronomists with no special training. In most cases farmers' practises were ignored but the importance of relating the experimental work with farmers' needs was recognized and led to the training of several (11, I believe) young, recently graduated agronomists in production courses in CIAT over the next two years. This group along with young agronomists that studied with Antonio Turrent and with a few others, including some foreign personnel, probably was the critical nucleus for the development of the on-farm research with its own special characteristics. Two other decisions were later put into effect that were to contribute to the evolution of on-farm research: (1) The establishment of socio-economics as a discipline in 1975 and (2) the establishment of in-service training in ICTA as a continuation of the CIAT agronomic production training.

Team-area policy

Early in the organization phases of ICTA a policy was established that the Institute would concentrate on-farm research in zones or areas, as contrasted with randomly attempting to cover the entire country. The second part of this policy was that within the zones or areas teams would be organized with the activities coordinated by a leader. Considerable emphasis was given to this policy, which without doubt was fortunate because otherwise ICTA would have been "running around putting out brush fires". It had also been decided to focus upon three main geographical areas and three zones were selected within these regions as the locations for the first three teams. The first year's on-farm technology screening was conducted within these three areas. However the commodity teams tended to ignore the selection of areas of priority and continued to work in the areas where they had been accustomed to work in previous years. The coordination, which has now been accomplished to a good degree, of the on-farm research and the commodity research could have been improved during the early phases of the Institute.

Establishing teams

The establishment of the on-farm research teams by region and year is shown in Table 2. The first two were located at La Maquina and Jutiapa and were so small as to be hardly considered teams. These teams were enlarged as trainees returned from CIAT and other study posts. All of the original three teams served as a focal point for expansion and furnished personnel for new teams.

Some team characteristics

Team size has varied considerably depending upon factors such as personnel available, financial resources, terrain and infrastructure and the status of agriculture within an area. In 1978 team average size was about 5.5 members per team, including the team leaders.

TABLE 2. SUB-REGIONAL ON-FA[illegible]MS [illegible] [illegible]EAR OF ESTABLISHMENT

	1974	1975	1976	1977	1978
REGION I		1. Quezaltenango	1. Quezaltenango 2. Totonicapán	1. Quezaltenango 2. Totonicapán	1. Quezaltenango 2. Totonicapán
REGION II	1. La Maquina	1. La Maquina	1. La Maquina 2. Nva. Concepción	1. Maquina 2. Nva. Concepción 3. La Blanca	1. La Maquina 2. Nva. Concepción 3. La Blanca
REGION V				1. Chimaltenango	1. Chimaltenango
REGION VI	1. Jutiapa	1. Jutiapa	1. Jutiapa 2. Chiquimulilla	1. Jutiapa 2. Chiquimulilla	1. Jutiapa 2. Chiquimulilla
REGION VII				1. Cristina 1/	1. Cristina 1/
Total Teams	2	3	6	9	9

1/ Not a complete team

Today most team members are general agronomists with some special training or have on-farm research experience. Most are young with less than ten years of professional experience. A few are Peritos Agrónomos, a vocational secondary degree.

In assigning people to teams their interest, both personal and professional were taken into account. If personnel with special training within a technical area were available the attempt was made to distribute them in the most logical manner possible. But no special mix of disciplines was sought as a minimum necessary to organize a team. When the socio-economics group was first established, their work was not integrated within the teams, some teams already having been organized previously.

There has been a tendency for team members of similar but no specialized discipline training to semi-specialize within a technical area according to their interests or team needs. Thus one might "bone up" more on weed control and another on fertility and another on analysis. This is what has been called herein semi-specialization. In this manner one team member complements another and contributes to the overall team effort according to his capabilities and knowledge. All team members conduct the same kind of trials so this "specialization" is not extended to the execution of the field work. This apparently is the manner in which socio-economics work of teams is now being handled, at least in some cases.

Team coverage

Just as team size has varied also the area covered has varied considerably. For example the initial area in La Maquina covered about 25,000 hectares with about 1200 family owners. The team assigned to this area did later initiate work in areas both to the east and west of La Maquina at Nueva Concepción and La Blanca. Now three area teams cover these areas which total about 80,000 hectares. But all three area teams function as part of the overall regional team, with each area team responsible for its respective area.

The initial area covered at Quezaltenango was only about 10,000 hectares with perhaps 15,000 families. The second team in Region I was at Totonicapán and probably initially covered an area of the same size and even more families. These two teams, which form the overall regional team in Region I, have now expanded the area covered to about 120,000 hectares with the same personnel. This was done by identifying technologies for the initial areas covered, and then increasing the coverage without abandoning the initial area. The teams at first concentrated on small areas and then were able to work more dispersely. This seems to be a reasonable and effective strategy and is, without much doubt, better than starting in a disperse fashion.

Training

ICTA has used three principal kinds of training:

1. Graduate level training. This has been mostly at the M. S. level. Study posts have been largely in the United States, Mexico, Brazil, Colombia and Costa Rica.
2. Short training abroad:
   a. Training in general agronomic production at international centers for several months. These courses were conducted by CIAT but are no longer available and have been replaced by the in-service training.
   b. Training of a few weeks or a few months in specific disciplines or on specific crops. Most of these courses have been at CIAT or CIMMYT.
3. In-service training has been conducted within the Institute. The course has been about 9 1/2 months covering a complete cropping season. Trainees dedicate about 70 percent of their time to field work. About 50 of the total training time is spent on research which is part of the institutional work plans. CIAT contributed by contract to the development of this course.

Problems of staffing and its management

There will be no attempt here to make an exhaustive explanation of the problems of person-el and its management. Some of the major problems will be mentioned, along with some expected problems which never became important.

The biggest personnel problem was resignation of highly capable personnel to take advantage of higher salaries of other opportunities for employment. This was the traditional problem of inadequate salaries, with the added pressure of increased opportunity because personnel had been well selected in the beginning and the ICTA experience made them attractive to both governmental organizations and private industry.

Lack of sufficient numbers of qualified people was only a problem at first, until people were trained. Then as mentioned above the problem was keeping hem.

The non-traditional character of the Institute and its work did cause problems in personnel management. The more traditional commodity programs, with better trained people, during the first few years imposed their ideas upon the on-farm teams. This problem was only slowly corrected through reorientation of the commodity programs along with the increased capabilities of the on-farm research personnel through training and experience. This was coupled with the fact that with time most of the commodity research people have come to understand, appreciate and respect the on-farm research.

Another problem was the integration of socio-economics as a new discipline with the biological disciplines. The problem has never been fully solved but is being met by using university trained agronomists with interests in the social and economic aspects of agriculture as team members rather than using Perito Agrónomos or university personnel trained in the social sciences.

One problem in developing the social-economic activities was not forseen. At first much of the field work in this area was assigned to sub-professional personnel. The problem was not so much technical as it was in developing relations between the socio-economic activities and the agronomic activities. The lower category personnel could not well represent and defend their discipline with the higher level trained agronomists. Since the Peritos Agrónomos (sub-professional) could perform useful functions, their assigment to this work was more an error of the management of the institute than a technical error.

An expected problem which never arose was getting agronomists to work efficiently at the field level. The Guatemalan agronomist responded to direction, training, and institutional support (transportation, etc.).

Extended absences from the Institute of trainees and students is a problem. Not only is their contribution to the institutional work lost but their understanding of institutional objectives and philosophy can change. The establishment of the in-service training course aided in correcting this problem, but of course did not solve it completely.

COSTS

I cannot include here accurate and substantiated costs of the on-farm research but can give some information and also make some estimates.

For example if I take the number of university level personnel and half their number of sub-professional personnel and compare this value with the budget for personnel plus operational expenses (excluding constructions and equipment), I find a cost of 16,086 dollars per person as an average over the period from 1973 through 1978. If we were to calculate 2000 dollars a year for new construction and equipment for each technician working directly in active research, either on commodity or on-farm, the cost is approximately 18,000 dollars per person. This cost includes management, administrative, operational, new construction, and maintenance. It does not include depreciation on constructions. There has been no adjustment for inflation. This calculation does not include either foreign personnel or external donations which were largely used for contracting foreign technical people.

If a similar calculation is made based on costs for each university graduate the average cost over the same six year period was about 26,000. Both of these estimates assume that all university level educated people work in research which was not the case. Reducing the number of university level people directly involved in research to allow for the few who worked in administration and management would increase costs slightly.

Two years ago I personally estimated that the cost of establishing a new tea of five would cost approximately 100,000 dollars per year.

DISCUSSION AND SUMMARY

What can be gleaned from the ICTA experience about staffing? I can only present some ideas, but I do believe that there is concensus about several aspect cf ICTA. Some of these are as follows.

1. Specific training for on-farm (FSR) research can be effective.
2. Much of this training can be better done, and at lower cost, within the country. Such training should be organized into a course, well structured and well managed. This can be organized as in-service training within a FSR zone. I feel certain that such training can be regionalized, using members of on-farm research teams as "instructors" to supervise the field work.

The advantages of regionalizing the training are several, but one is that the trainee could contribute to a team effort and the work in a region rather than in the one area where the course might be located. This would probably necesitate bring trainees from their team areas to a central location for some classroom and workshop sessions.

In-service training by assigning new professionals to work directly with an experienced member of a team can also be effective. The team environment can be a very good one for learning, but more structured training is more complete and uniform.

3. There was no major problem in getting the Guatemalan agronomists to work at the farmer level if they were given guidance and institutional support.

4. Forming the personnel into teams is more effective than using the same number of people in a disperse manner. In ICTA different teams formed sub-schools of thought in relation to technological strategies and methodologies. This, given guidance, can contribute to the evolution of strategies, procedures and methodologies that allow FSR to be molded according to local conditions.

5. Limit the size of the area for a team to that which can be well covere especially at first. There is an indication that a given team can cover a much larger area effectively with time and experience. In part this is due to the experience of the personnel but also to the fact that much information is gained about a given area during the first few years that does not have to be studied continuosly, but only refined and updated.

With regards to costs I can contribute little that applys specifically to on-farm research or FSR.

In ICTA where the majority of the technical personnel consisted of about 2 university graduates to 1 sub-professional the costs for this mix of people was estimated at 18,000 dollars per person. If the cost is estimated per professional (university graduate), using the cost of the sub-professional as a costs of the professional the cost was estimated at 26,000 dollars per person. These calculations were made assuming that the cost of commodity research per person is the same as for FSR, which probably is the case.

However the use of the funds for the on-farm activity is for different purposes than for commodity research' For the on-farm activity vehicle and fuel costs are greater. For commodity research equipment and experiment station costs are greater. On-farm research may need additional funds for per diem and salary supplements for living in an unfavorable area or compensation to return to the family.

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Notes by the Author.

(1) Any review of the staffing and funding of ICTA from the viewpoint of FSR should take into account that ICTA has a broader spectrum of activities than strictly FSR in that it also includes commodity and discipline research. This commodity and discipline research is more traditional than the on-farm research and focuses largely upon components. This kind of research in ICTA is no longer as traditional as many commodity programs, having been influenced and reoriented through the on-farm experience within the Institute. There are also "services" such as Seed and in-service Training. The on-farm research of ICTA easily falls within the definition of FSR but some of the commodity research might not, depending on the definition of FSR. However, the reorientation of the commodity research has been such that in a broad sense they have become part of the FSR, and they certainly are an important part of the ICTA system.

This over-lap between commodity programs and field level research (FSR) accrues advantages to FSR but it has a cost because the on-farm teams conduct some field trials wherein the principal objectives are commodity research. The on-farm teams are a mechanism through which the commodity research is advanced in a more pragmatic manner than frequently is the case and results in a meld of activities. A discussion of the reasons for this arrangement, which I consider important ones, is not the subject of this presentation, but it does affect the kind of staff needed and makes it more difficult to assign costs. For these reason it is difficult to separate staffing needs and costs for FSR within the Institute to the degree which would be desirable for this symposium. In some cases I have relied upon memory to partition data or to fill in missing data. In most cases, however, data have been taken from existing reports. Some of these reports have not been released for general distribution.

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(2) ICTA was not established as a FSR Institute. ICTA had a mandate to make research more relevant to the use of technology by small farmers in order to improve their well-being. To do this a new dimension was added to the traditional commodity programs. These commodity programs are no longer as traditional as they were a few years ago. To what extent the commodity programs should be included or excluded from FSR is not clear to the author. In this paper either "on-farm" or FSR is used to indicate those activities which I believe are normally conceived as FSR.

THE ICTA CASE

THE LINKAGES WITH OTHER NATIONAL, INTERNATIONAL AND REGIONAL INSTITUTIONS

Porfirio Masaya*

I INTRODUCTION

We must first say that frrm the early stages of ICTA development, the transfer of technology was visualized as a process that includes imputs from International Centers, Universities and Private companies (See Fig.1) New technologies are constantly being developed in International Centers, for example, and new farm chemicals are being developed by private companies. These technology and innovations need to be validated under farm conditions.

II INTERNATIONAL CENTERS

The relationships will be presented on the basis of the stages of technological development that have been described previously in this meeting. The relationships of ICTA with foreign or international institutions have been developed mainly with the International Centers. Fig. 2 shows the relationship between ICTA and technological centers and advising and funding institutions. As an example, CIAT supported ICTA bean program with germplasm, and technical advice from CIAT scientists. Later those linkages developed further; CIAT with AID funding, assigned two scientists, one plant breeder and one plant pathologist on a full time basis. CIAT also began as it does for other countries recombining genes for resistance to Bean Golden

*Formerly with ICTA

Mosaic Virus, Rust and adaptation. Fig. 3, shows the scheme for the cycle of crossings, selection and recombining of resistance. As a product of these cycles the breeders selected lines for yield tests under severe disease pressure. The best lines were selected then and transferred to the regional teams for small farm testing under the farming systems in several regions. In each cycle, the breeders in CIAT recombine the best selections and eventually the best lines from farm trials for increasing the amount of resistance. This scheme links the work in an international center through the National Comodity Program and through the technology testing groups with the farmers fields. For this scheme to function it is necessary excelent communication lines between breeders in ICTA and breeders in CIAT. The project was started during the last part of 1977. In 1980 we are realising the first varieties to farmers. During that period of time the sources of resistance were crossed the selections done, the lines tested under farmers conditions and seed multiplied. The linkages of CIAT and ICTA also include segregating lines and information for the rice program in ICTA and plans ar being advanced for cooperation in animal production research.

The linkages of CIMMYT maize program and ICTA FSR program have evolved similarly. ICTA maize program was strenghtened with two scientists. The program produced the varieties and hybrid for the farm trials carried out under the farming systems in several regions of Guatemala. In this case the involment of CIMMYT in the FSR program came by the interaction of these two scientists with the regional teams. This interaction included:

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a. The envolment of breeders from CIMMYT on a full time basis, in the maize breeding program in ICTA.

b. The asistance of the maize breeders to the technology testing groups in the establishment and gathering of experimental data.

c. The involment in training and pertinent scientific meetings.

d. The involment in seed production and promation policies for seed disemination.

The linkages of ICTA and the international centers have been developed mainly between the research teams there, and comodity crops programs in ICTA. An important part of these linkages pertain to the training of young scientists of ICTA in the comodity crops programs of international centers; CIAT has trained members of ICTA from 1973 to 1980. CIMMYT, for example has trained 21 members of ICTA Maize Program. The training included areas of plant breeding, plant pathology, plant physiology, agronomy, microbiology, entomology and economics, and in some cases the experimental research for graduate study. In some cases the linkages of ICTA and International Centers include the farm testing for materials or technologies developed in the Centers. The first evaluation is done under experimental - station conditions and includes lines, varieties or populations from international centers breeding programs. This stage of the work is done by the - comodity crop programs. The most promisory lines or methods are later advanced to the farm testing groups and compared with the lines produced locally. In maize, beans, rice, wheat and sorghum, the bulk of the effort has been done, so far, in the realm of plant breeding. More often ------

than not a new variety has been found to be one of the most important factors for increasing productivity or reducing risks in small farming systems. The experience has shown also that more rapid progress is done in plant breeding when the selection is done locally starting, from the early generations or when the crossings are done locally. As R. K. Waugh states in his discussion of ICTA phylosophy (1) its relationships with international centers have led it to becoming a part of the international research communuty. A good example of this is the cooperative work for resistance against downy mildew in maize, being conducted in El Salvador, Honduras and Guatemala with CIMMYT involment. ICTA cooperates with ICRISAT in the distribution of lines of sorghum to other breeding programs in Central América, and participates in the sending of a National Nursery of beans to other Central American institutions.- The breeding for resistance to Golden Mosaic Virus is being done in cooperation with El Salvador research teams.

CATIE (a) a regional institution in Central América, has two - projects with two different types of linkages with ICTA. Their effort is directed in one project to-ward the identification of alternatives for farming systems, using the crops ICTA is working with. The project has four parts:

1. Research
2. Validation
3. Extrapolation (to other countries or regions)
4. Training

(a) Centro Agronómico Tropical de Investigación y Enseñanza. Costa Rica.

The ICTA Case . . . .

This project has had less direct interaction with the technology testing groups and is being conducted, so far, in one region in the country.

A second project was started in 1978 for research in the Pacific Coast in animal production.

A different pattern of cooperation was stablished with CIP. In this case, the central american and Caribbean countries form a cooperative project for research in potato production and storage. ICTA cooperates as a partner for the whole project which is funded with Swiss assistance.

The strenghtening of multidisciplinary teams in ICTA has been stressed before. Part of this is being done through the training of agronomists in international centers.

INCAP, Instituto de Nutrición de Centro América y Panamá, is a regional, and well known research institution. The linkages of ICTA and INCAP, were developed through projects for improving the nutritional quality of maize. In this case ICTA asigned two technicians in INCAP for the analysis of maize for protein and aminoacids. INCAP also provides computer facilities for ICTA.

III THE NEED FOR EVALUATION OF THE EFFECT OF NEW TECHNOLOGIES

During the first seven years of ICTA, the bulk of the effort has been done in the identification of the major constraints in small farming systems and in producing materials and methods for solving some of the major constraints. Undoubtedly this effort needs to be continued, but at the same time, we need to evaluate and to document the impact of the technological changes that ICTA is recomending for small farms. This is an area where international centers and foreign universities could cooperate.

IV SPONSORING AND FUNDING INSTITUTIONS

At the present time no formal relations exist between ICTA and other funding or sponsoring institutions but, ICTA has received substantial asistance from AID, the Rockefeller Foundation and the Interamerican Development Bank. AID has provided funding for projects on improvement of varieties of beans sorghum and maize. AID also provided funding for training of Guatemala scientists in the United States and in Latin America. The Rockefeller Foundation provided the experience for organizing ICTA and also funding for graduate training in the United States and Latin America, The Interamerican Development Bank has sponsored and in-service training course for guatemalan agronomists in small farm research methods.

V. FINAL NOTE

It is very difficult for a research team in a University or International Center to know or visualize what farmers in a country need. This assert is more obviuos in farming systems. This is not to say that scientists in the International Centers or Universities are not know-ledge-able about the agriculture of a given country. But even at a national level in a small country like Guatemala there is a great diversity of farming systems, ecological conditions and farmer's attitudes. Nevertheless, our experience in ICTA has shoown that the success of foreign or international cooperation is most success-full when a local program can identify the priorities to which the international asistance must be adressed. Very often we find that a problem known locally, also occurs in other countries. The International Centers make possible the exchange of materials, skills, or information between countries that would occur otherwise very slowly.

2. THE NATURE OF THE LINKAGES BETWEEN ICTA AND OTHER NATIONAL INSTITUTIONS RELATED TO AGRICULTURAL DEVELOPMENT.

The relationships that exist between ICTA and the other agricultural institutions in Guatemala have a more formal frame, than those existing between ICTA and the International Centers. The linkages are ment to fuction at two levels:

a. National level

b. Regional level

a. National Level

By law, the institutions related to the agricultural development, are grouped in a structure known as the Agricultural Public Sector, APS. (This - concept divides the agricultural activity in two parts: The Private Sector that embodies the private companies and farmers, by one hand, and the Public Sector that includes the institutions and agencies of the central government.)

The APS is directed by the Minister of Agriculture who also has a seat in the National Council of Economic Planification. The activities of the sector are supposed to be in accordance with the economic development planification. There are other agencies related to the economic planification that articulate and ensure that the policies and priorities of economic planification are coherent.

The APS is composed by 5 agencies of the Ministry of Agriculture

1. DIGESA (Dirección General de Servicios Agrícolas)

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2. ICTA Instituto de Ciencia y Tecnologia Agricolas
3. INDECA. Instituto de Comercializacion Agricola
4. INAFOR. Instituto Nacional Forestal
5. BANDESA. Banco Nacional de Desarrollo Agricola.

We will describe briefly these five institutions:

DIGESA

This is a centralized agency of the sector that is part of the administrative body of the Ministry of Agriculture. Their functions are to provide the direct transfer of technology to the farmers. There is not a commitment to the size or type of the farm to be served. Never-theless, funds for the program for transfer of technology state that the first priority is the small and medium sized farmer. (The ammount of land actually used by the small farmer varies from one region to another within the country) DIGESA transfers technology to farmers through extention agents and " promotores "technicians whose main responsability is to provide technical assistance in food grain crops.

ICTA

Is the decentralized institution responsible for generating and promoting the use of technology. There is no mandatary legislation establishing the small farmer as target. It is directed by a Board of Directors headed by the Ministry of Agriculture. The Minister of Economic Affairs, the Minister of Public Financing and the Secretary for Economic Planification are part of the Board of Directors.

INDECA

It is the decentralized institution of APS responsible for the esta bilization of price of agricultural products. Although there is no mandatary legislation relating the products to be worked the Institute has been working mostly with basic food grains that in Guatemala are produced mostly in small land holdings. It is directed by a Board of Directors with some of its member being the same oficials that are included in the Board of Directors in ICTA. This Institute estabilizes the prices of food grains, by buying and storing a part of the national harvest, and selling it when the prices are going up.

INAFOR

This institute administrates the policies of the gorvernment for the conservation and utilization of forest resources in the country.

BANDESA

This is the National Bank for agricultural Development. The bank - provides the financing for traditional farmers. The financing is done on a per crop basis using estimated fingures of cost per unit of area of land for each crop, or combination of crops.

The Director General of each of the five institutions meet weekly - with the Ministry of Agriculture for evaluation of, and decision making for, the advance of the established policies and this group is known as COSUCO, the superior council of Coordination. It is at this level that the coordination of the policies and the evaluations of advances are made at a national level Two areas of prime importance for FSR objective are:

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1. The implementation of a flow of comunications between research and promotores, the agants in charge of the actual transfer of technology to farmers.

2. The availability of credit for farmers in:

   a. Their location; and,

   b. The right time of the year

COSUCO: Supervises the correct implementation of policies and strategies that to some extent are fixed in National Plans for Economic Development. As an example, such plans have defined the regions of the country where production of maize has priority. This priority means for example, that in "Parcelamiento La Máquina" an area of the South Coastal Plains, ICTA will generate technology for maize production; such technology will be transfered in that area by the promotores of DIGESA. The credit for maize production will be supplied by BANDESA in that area; finally in order to stabilize prices INDECA will buy and store an amount of corn grain in that area. This means that planification for a given area has to be coherent in all four institutions.

b. <u>Regional Level</u>

It is desirible to have the same degree of coordination among agencies at national and at regional level. In order to facilitate the establishment of objectives, tha country has been divided in regions and sub-regions. The definition of regions was made on the basis of ecology, type of farming systems, Farmers and infrastructure. Such scheme was established before the FSR program was started in ICTA. In Guatemala there are 7 of such regions and most of them are subdivided in two or three sub-regions. In each region - each institution has a Director, and the set of five directors in a region form a Regional Committee of Development. (RCD).

The RCD holds meetings at least once a month and seeks for a close coordination at regional level, as the COSUCO does at national level. Since the regions are a homogenous area, the RCD has to deal with fewer farming systems, in localities not too for away and so they can go to a more detailed exam in their meetings compared to COSUCO.

The explanations given above indicate as stated in the begining of this chapter that the linkages of the FSR program in ICTA with extension service and other national support institutions is formal. It is clear that the linkages do exist but the actual coordination and chanels of information are not guaranteed by those formal linkages.

The chanels of information fuction at sub-regional level and include:

1. Field days
2. Meetings eith farmers, researchers and promotores
3. Joint projects (ICTA personal and promotores)
4. Courses.

These four ways of information flow operate mainly in a downstream fashion with litle feed back information from promotores ot FSR researches.

The ICTA Case . . . .

During the years the FSR of ICTA has been functioning there has not been an aproach for a direct transfer of technology by the regional teams. This has been so because DIGESA personell has such a responsability. The FRS in ICTA projects give a by-product of transfer of technology because farmers become involved in the research process, but it must be stressed that in the FSR methodology in ICTA, even in the test plot, managed by the farmer himself, we are still dealing with a research process. Up to now - the nature of linkages between the regional teams in ICTA and promotores - have deveoloped mostly on a limited basis.

Since 1979 three courses have been functioning in three different regions of Guatemala. The courses are designed to transfer technological information to the promotores or to inform them about the current innovations. The courses seem to be a success but the follow up proccess by the promotores is not satisfactory. Two points need to be improved in the future relating the linka ges of FSR and promotores.

1. The courses have been designed for the promotores but their supervisors have not received the courses. Because of that, they (The supervisors) do not feel confident abount the new technology and - seem reluctant to support enthusiastically the promotores once they go back to the communities they will attend.

2. There are substantial differences in the logistic facilities in - ICTA compared to DIGESA, the latter has more centralized administrative services and the proccessing of documents is slow; this -

this fact needs to be changed because it affects the timely purchasing, and distribution of materials.

3. THE IMPLICATIONS OF THE FSR FOR THE AGRICULTURAL DEVELOPMENT AND PLANNING.

The Agricultural Plan of Development existed in Guatemala prior to establishing of the FSR in ICTA. Maybe we can think of the establishing of ICTA as a response to a need in the agricultural planning. The general Development Planning started in the country in 1971 implicated the generation of technology for small farmers. This objective was two fold: First the small farmer and his family need to improve their standard of life; second they produce their own food and the major part of the national harves of grain, which needs to be increased.

The ICTA's FSR program has proven to be far more effective than the scheme for agricultural research that existed before. As stated before - there is the need for documenting the impact of the new technology in specified areas of the country. There are for example clear indications on the aceptability of seeds of improved varieties. Table 1, shows the trend in seed production of corn varieties and hybrids produced by ICTA maize - program (1). In 1976 there were 318 tons of seed produced in the country. In 1980, 1100 tons have been produced. In 1981 the production will rise to 2,900 Tons.

TABLE 1. PRODUCTION OF CORN SEED IN GUATEMALA. OPEN POLLINATED AND HYBRIDS DEVELOPED BY ICTA (1) IN METRIC TONS.

	1976	1980	1981
Produced	318	2100	2900
Sold	136	1100	

During 1980 there were 20,000 Ha. planted with hybrids and open pollinated varieties developd in ICTA. During 1981 we expect there will be 175,000 Ha. planted with ICTA corn varieties.

The FSR scheme used in ICTA has had two main implications. First the small farmers are now more familiar with research work in rural Guatemala. May be more noticiable is that agronomists are now more familiar with the methods and problems of small farmers.

This includes, of course, the use of farming systems. As FSR regional teams are strenhtened their experience increases and some of their members are trained in graduate study, the FSR in Guatemala will be more and more in site determined being at the same time coherent with national level planning.

PNMS/mau.

Dic. 8, 1980.

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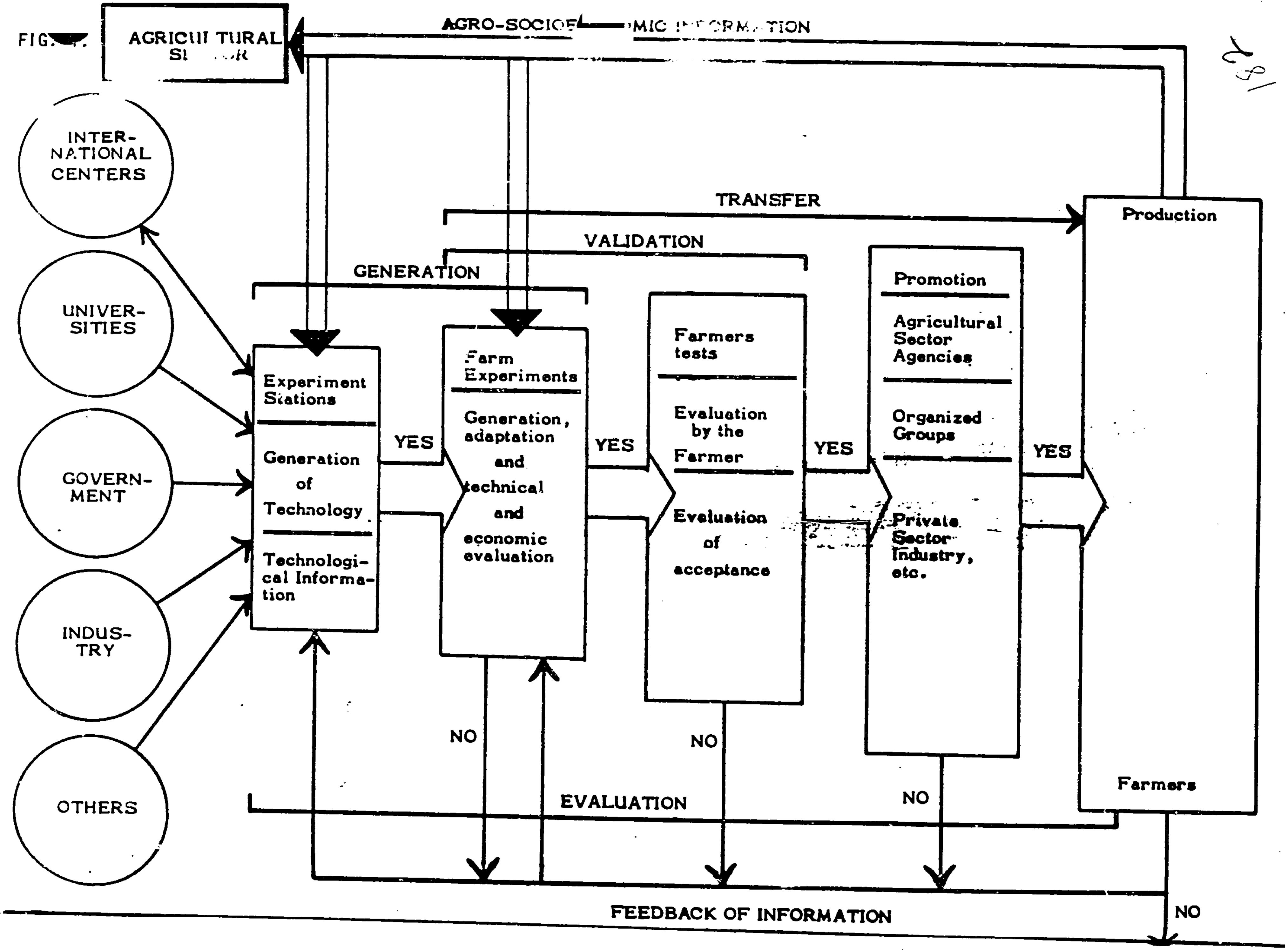
FIG.


AGRICUI TURAL
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UNIVER-SITIES
GOVERN-MENT
INDUS-TRY
OTHERS
TRANSFER
VALIDATION
GENERATION
Experiment Stations
Generation of Technology
Technological Information
YES
Farm Experiments
Generation, adaptation and technical and economic evaluation
YES
Farmers tests
Evaluation by the Farmer
Evaluation of acceptance
YES
Promotion
Agricultural Sector Agencies
Organized Groups
Private Sector Industry, etc.
YES
Production
Farmers
NO
NO
NO
EVALUATION
FEEDBACK OF INFORMATION
NO

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FIG. 2. LINKAGES OF ICTA AND OTHER FOREING, REGIONAL AND INTERNATIONAL RESEARCH INSTITUTIONS.

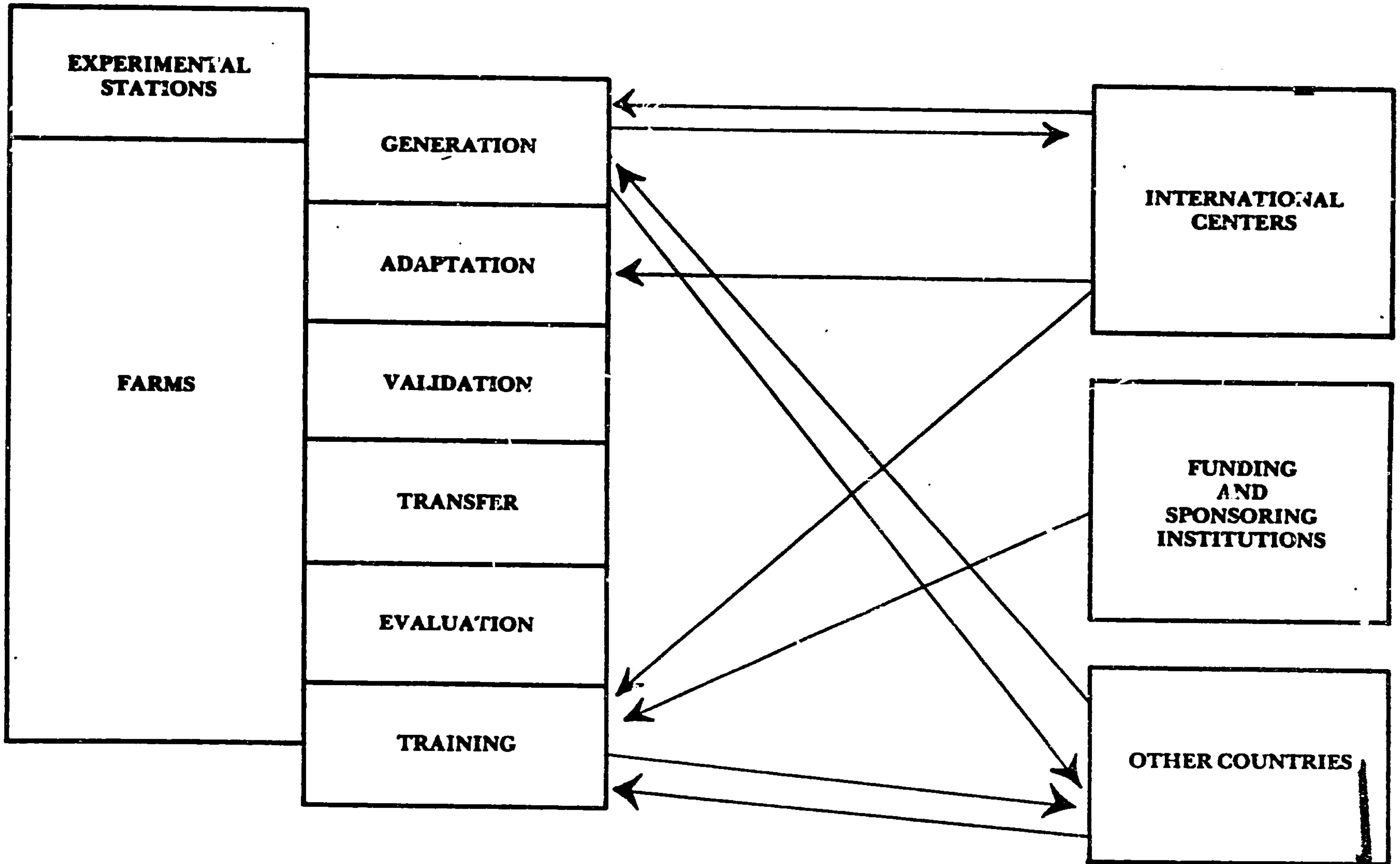
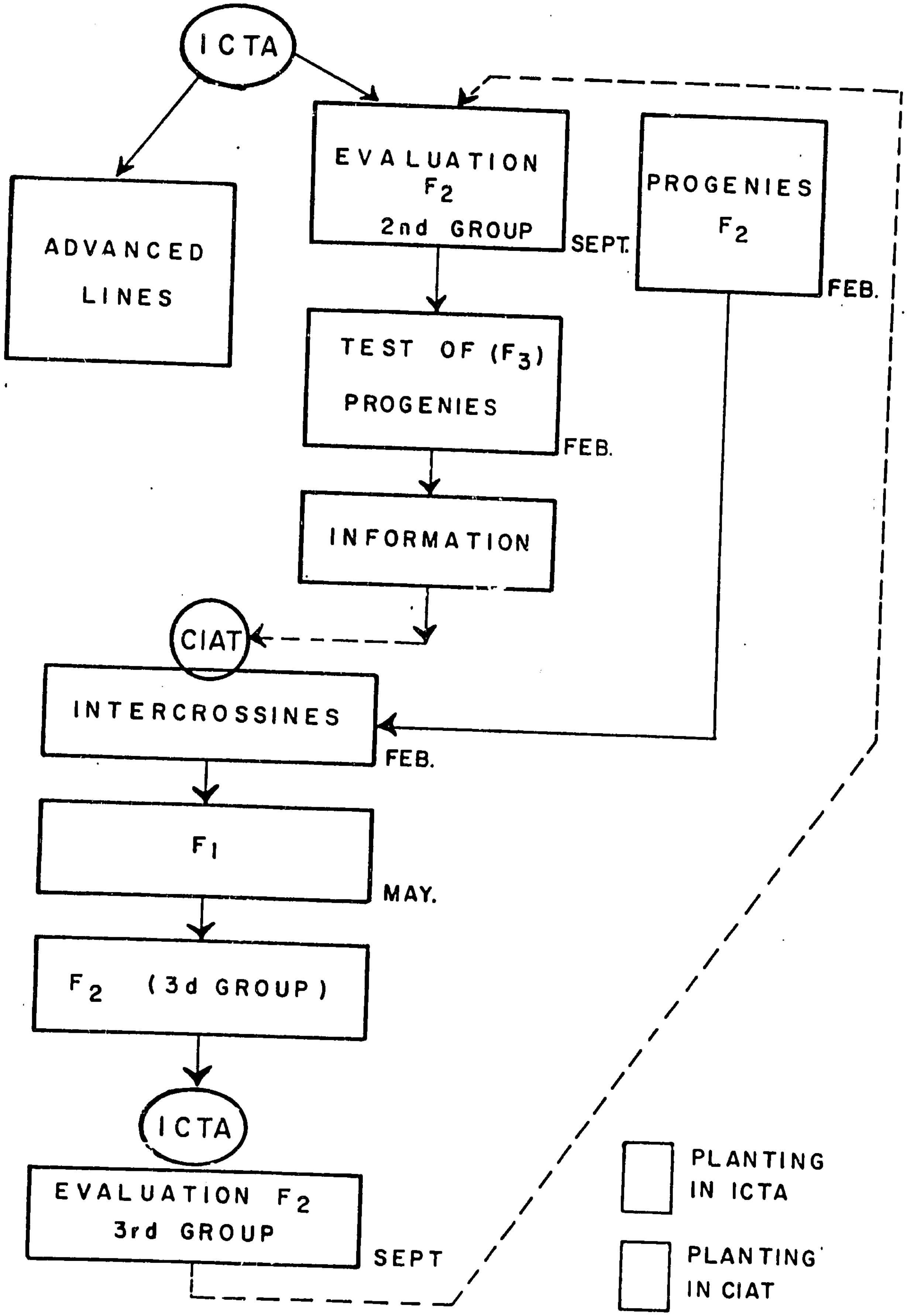


FIG. 3. SCHEME OF ONE CYCLE OF RECURRENT SELECTION, IN BEANS FOR RESISTANCE TO BEAN GOLDEN MOSAIC VIRUS. ICTA-CIAT COOPERATIVE PROJECT.



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AID-USDA SYMPOSIUM ON FARMING SYSTEMS RESEARCH

Washington, D.C.

December 8 and 9, 1980

DISUCSSION GROUP REPORTS: SUMMARY

I. Introduction

Following the last of the symposium's prepared presentations, participants met in five small groups for more detailed discussion of the questions and issues raised during the formal presentations. To the extent possible, the symposium's organizers attempted to assign participants among groups so as to create maximum diversity of interest, experience, and institutional ties. After the small group meetings, group leaders reported in plenary session on the results of these discussions. The reports were not formally written for delivery to the session. What follows below is a review of notes taken during the reports by several of the participants.

The reports indicated that there was a great deal of commonality among the groups concerning issues of interest. This review, therefore, makes no attempt to characterize the make-up of each group or to identify any one point with a particular group.

II. Review of Small Group Discussion

A. Concepts and Methodology

Group reports showed evidence of a continuing struggle with the concept of Farming Systems Research. At one level, the comment that "There is nothing new in FSR", for example, suggests that the organizer of the symposium and the speaker did not adequately recognise that many in the audience were new to the concept. Group leaders noted that more attention could usefully have been given to (1) explicit comparisons of the FSR approach with more "traditional" approaches in farm management and the technical agricultural sciences, and (2) a discussion of the development approach or philosophy on which FSR is based. Elements of the approach include:

-Recognition of the viability of small farm production systems.

-Recognition of the importance of these systems to national overall agricultural production.

-Improvements in these systems are incremental.

-Improvements are environmentally specific.

At another level, there appeared to be the impression that FSR promised somewhat more than it delivered. Thus the concept of holism demands that the researcher concern himself with the farmer, his family, their farm production activities and their off-farm activities as an irreducible whole. In practice, however, most investigators limited their attention to farm production activities, and these were almost exclusively crop activities. Most present FSR programs might be better termed Cropping Systems Research, rather than Farming Systems Research.

Diversity among symposium speakers as to methodology was noted. This diversity relates, in part, to the role that social sciences play in the implementation of the FSR programs. Generally, programs of the international and regional research centers (CIMMYT, IRRI, CATIE, etc.) utilize social scientists more extensively than do national programs. This is, no doubt, based largely on the differences in available resources.

Group discussions also noted the diversity in the views of speakers regarding the feasibility of the transfer of technology to areas other than those targeted for study. Investigators working on rice-based cropping systems in Southeast Asia reported that transferability was relatively easy due to the relative homogeneity of environments in which rice is produced. Those working in Central America argued that great variety in soils and topography inhibited ready transfer outside the research site. In Africa the need to work through diverse local power and social structures required specific research for each locale. In commenting on this aspect of diversity, one group leader noted that, in any case, if new technologies were to be presented to farmers outside the target area, the transfer agents must specify the group of farmers to be reached.

Finally, speakers had difficult perceptions concerning the amount of target area data necessary to initiate an investigation. At one extreme, the majority position was that a rapid survey, carried out by experienced observers with only a short list of key questions, is adequate to identify major constraints and technological opportunities to permit on-farm and experiment station research to get underway. At the other extreme, the minority view was that an extensive survey of the target area, with detailed data on technical and socio-economic variables, was necessary.

Despite these elements of diversity, group leaders commonly noted the unity underlying all presentations such that FSR represents more a philosophy of approach to agricultural research than it did a unique methodology. FSR is an explicit attempt to understand a group of farmers whose resource and environmental constraints result in their inability to adopt available technology. In addition, it gives on-farm experience to the increasing number of scientists who are of urban origin, enabling them to "stand in the farmer's shoes" in order to understand why there is little or no adoption of technologies under existing modes of research and extension and helping them to focus their research on problems relevant to farmers.

To most effectively accomplish this, an interdisciplinary approach must be taken. Expertise is required in these general areas:

-Biological-technical

-Economics (farm management)

-Sociology

Conceivably, this could be achieved in one investigator, though a team would normally be required. On the make-up of the team, some discussants argued that it was less important to get the optimum mix of specialties than to have persons who can work well together on the farm and with farmers. Strong team leadership and the personal dedication of team members is critical.

Several discussants stated that extension was not given sufficient attention in the symposium. Farmers' access to improved technology demands a close relationship between the research and extension processes. In FSR the distinction between these two functions becomes blurred and may even disappear. FSR is relatively less demanding of scientists highly trained in their specialties and relatively more demanding of large numbers of scientists with lower levels of training. To staff FSR programs, the extension services may well be the major source of the numbers required. In any case, the extension worker is often the avenue for feed-back of program results into the FSR process, and close cooperation between the extension worker and the researcher enhances the product of both.

B. Organization and Implementation

Discussants were concerned with a number of organizational and implementation questions on how to initiate FSR programs in developing countries. It was observed that entrenched bureaucracies are often the first barrier to be overcome, requiring strong political leadership at the national level.

Training is always an important input to new programs, and an element of training, often forgotten, is that for top decision makers. In the FSR case this would have to be of such a nature as to give them the necessary basis for evaluating the potential costs and benefits of an FSR program.

With regard to organization, discussants felt that an FSR program which was seperated from the existing established agricultural research establishment would weaken potential complementarities with commodity research programs. It was suggested that "piggy-backing" on commodity programs would be a good way to get FSR activities underway.

Other discussants suggested the symposium did not dig deeply enough into organizational questions. Concern was raised over the role of the agricultural experiment station under the FSR approach. How was it, and the resources it represented, to be made more effective? Some questioned the performance of the extension function by the FSR unit, suggesting that that function ought to remain organizationally separate.

Incentives to farmers were of concern to some discussants. In some cases cooperating farmers were subsidized with free or low cost inputs, but these are usually not available to non-cooperating farmers to whom innovations must be diffused. Lime and good seed were mentioned as being very important inputs often not available except at high cost.

Other aspects of farmer incentives which were felt to be important were remunerative product prices and a government responsive to needed changes in infrastructure, such as credit, transportation, and marketing facilities, as revealed in the FSR process.

One set of observations concerned the role of outside agencies interacting with national FSR programs. The international and regional research centers were mentioned as being valuable sources of prototype improved systems and as training centers for national workers. Also mentioned was the problem of utilizing expatriate technical assistance. Foreign scientists are likely not to be skilled in the FSR mode of operation, but their disciplinary expertise may still be required. How can FSR programs effectively use such experts?

A sub-set of these observations focused on the problem of scientific training of developing country agriculturists in U.S. and Eurpoean universities for work in FSR programs. The long-standing issue of the applicability of such an education to developing country problems becomes even more relevant in the highly applied framework of FSR. In-service training to supplement degree training was suggested as an essential element of the national FSR activity.

Related to the question of training is that of professional recognition as part of the incentive structive for FSR staff.* Most agricultural scientists are conditioned to the notion that publication in professional journals is the best way to gain recognition. It was suggested that much FSR work is potentially publishable, and that the professional societies should be approached to assist in facilitating this.**

As a final comment, one discussant asked, whether FSR had matured as an approach to agricultural research or was still developing. He argued that the aspect in greatest need of further development was that of diffusion of new technology beyond the target area in which research had been conducted. Also, there appeared to be agreement that ways should be found, assisted, perhaps, by AID funding, to encourage exchange of information among FSR workers and administrators. This implies that if it is not fully mature, the FSR approach is sufficiently so as to receive unique recognition among the agricultural sciences.

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*This is also an issue for the expatriate spending part of his career assisting national FSR programs.

**One section of the 1980 annual meeting of the American Agricultural Economics Association was devoted to a review of farming systems research programs.

AID-USDA SYMPOSIUM ON FARMING SYSTEMS RESEARCH

Washington, D.C.

December 8 and 9, 1980

LESSONS FOR THE FUTURE

Panel Presentation

I. Introduction

The penultimate session of the symposium was a presentation by a panel composed of two U.S. Government officials whose agencies are concerned in the development and support of FSR programs and two scientists with years of experience working in such programs. The panelists were:

--Dr. Quentin West, Director of USDA's Office of International Cooperation and Development.

--Dr. John Yohe, Head of the Division of Agricultural Production in the Office of Agriculture of AID's Development Support Bureau.

--Dr. Jerry McIntosh, International Rice Research Institute.

--Dr. Peter Hildebrand, University of Florida.

What follows is a summary of their brief presentations based upon notes taken by symposium participants during the panel's presentation.

II. Panelists Remarks

A. Quentin West

Dr. West stated his concern over maintaining the momentum of interest in FSR which had been generated by the symposium. He pointed out that copies of all papers presented at the symposium would be made available to the participants and then suggested two types of follow-up actions that could be taken:

1. Continuing communication among agencies and individuals concerned with FSR programs. A newsletter might be the most efficient mode for carrying this out. He suggested that John Hyslop, OICD, chair an ad hoc committee to explore this.

2. Annual meetings of practitioners and other interested persons. He proposed the first of these could be held at CATIE in Costa Rica.

B. John Yohe

Dr. Yohe first mentioned that the Development Support Bureau's Office of Agriculture is designing a support project for FSR programs in the developing countries. He then stated that FSR has a definite place in the agricultural research establishments of developing countries, and its spread among these countries is gaining momentum.

Further points made by Dr. Yohe were

1. There is much to be learned from the experience of FSR programs now underway. There is now no mechanism in which FSR workers in one program can learn from those in other programs. The idea of continuing and/or periodic communications should be supported.

2. Means should be found to give FSR a professional status in order to help attract and hold young professional workers from both the U.S. and the developing countries.

3. The Joint Research Committee of BIFAD is planning a research project in FSR. With strengthening grants under Title XII, universities are beginning to invest in FSR expertise.

4. A serious problem in agricultural research is that too many professional agriculturists have no farm experience. This has always been true in the developing countries and is becoming more so in the U.S. FSR provides a means of gaining that experience.

C. Jerry McIntosh

Dr. McIntosh stated that he found the symposium to be a useful meeting. He noted his interest in learning about FSR programs in different stages of development. He supported the idea of periodic FSR review meetings and suggested that future meetings might be regionally organized. As an example, he mentioned that he had visited the ICTA program in Guatemala this summer for the first time.

Although he had previously heard the program described, he found it useful to see it in operation. He noted his particular interest to see the similarity of problems he had faced in Indonesia with those of ICTA, and the uniqueness of ICTA's solutions.

To donor agenices considering assistance to FSR programs he offered several suggestions:

1. Support should be over a long period of time. No less than five years was suggested.

2. Donors should support the establishment of a common basic methodology.

3. Objectives at the outset should be limited. It is difficult to accomplish anything if initial objectives are too broad. They can be broadened as the program gains maturity.

4. Donors can assist with specific technical problems as they arise over the course of FSR implementation. Experts in particular agricultural disciplines are useful even though they are not conversant with the FSR approach.

5. In-country training of FSR workers is most effective. Donors should give relatively more support to this rather than degree training in developed countries.

D. Peter Hildebrand

Dr. Hildebrand argued that location specificty is important to the FSR methodology. This can be due to either the physical or the socio-cultural environment. He noted that technology diffusion beyond the research site in Asia is likely to be easier than in Latin America due to the relative homogeniety of paddy rice culture in the former area. In each region, however, a relatively open culture permits the effective use of the rapid survey to determine constraints and research opportunities. In Africa technology diffusion may be difficult and the rapid survey may not be effective due to the need to understand and work through the social hierarchy in each locale.

In regard to personnel development, he maintained that staff incentives may be difficult to apply due to the difficulty of making objective personnel evaluations. In the ICTA program professional evaluation was possible, though not easy, due to the total commitment of the agency to the FSR program. For example, field staff evaluations are based on the rate of adoption of new technologies by farmers in the target area.

He also asserted that academic training in FSR at the graduate level is as important as in-service training.

AID-USDA FARMING SYSTEMS SYMPOSIUM

Washington, D.C.

December 8 and 9, 1980

Summary of closing remarks by Tony Babb, Deputy Assistant Administrator, Development Support Bureau

Mr. Babb briefly summarized the importance of the Symposium for AID development assistance efforts. He expressed his pleasure that this conference was held, and noted the experience and stature of those who had been drawn together by it. He observed that FSR is an important area of work and mentioned that the Development Support Bureau would be actively supporting FSR programs through a project to be implemented by the Office of Agriculture and the Office of Rural Development and Development and Administration. This project will recognize both the technical and the socio-economic aspects of technology development and transfer.

FARMING SYSTEMS RESEARCH SYMPOSIUM PARTICIPANTS

Craig Ahlberg
Room 4134, South Building
Farmers Home Administration
U.S. Department of Agriculture
Washington, D.C. 20250

Curtis Absher
USDA/SEA
Room 220, Building 005
BARC-West
Beltsville, MD 20705

John Aldonas
USDA/FmHA
Room 4131, South Building
Washington, D.C. 20250

Robert Anderson
USDA/SEA/CR
Room 6415 South Building
Washington, D.C. 20250

Gordon Appleby
938 Concha St.
Altadena, CA 91001

Joan Atherton
AID/PPC/PDPR/RD
Room 2675 NS
Washington, D.C. 20523

Tony Babb
Deputy Assistant Administrator
AID/Development Support
Room 513, SA-18
Washington, D.C. 20523

Barton Baker
P.O. Box 149
Elkins, West Virginia 26241

Heather Baker
National Rural Center
P.O. Box 185
Boalsburg, PA 16827

Randolph Barker
349 Warren Hall
Cornell University
Ithaca, NY 14853

Ovid Bay
USDA/SEA/Extension
Room 6818 South Building
Washington, D.C. 20250

Joseph Beausoleil
AID/DS/RAD
Room 506, SA-18
Washington, D.C. 20523

George Bradley
Department of Horticulture
and Forestry
University of Arkansas
Fayetteville, Arkansas 72701

Frank L. Brewer
USDA/SEA/Extension
Room 326, Building 005
BARC-W
Beltsville, MD 20705

Gerald Britan
USDA/SEA/Joint Planning and
Evaluation
Room 6008 South Building
Washington, D.C. 20250

Mary Burfisher
USDA/ESS
390 GHI
Washington, D.C. 20250

Rebecca Burt
AID/LAC/DR/RD
Room 2239 NS
Washington, D.C. 20523

James Butcher
USDA/SEA
Room 470, Federal Building
Hyattsville, MD 20782

Keith Byergo
12800 Wycklow Dr.
Clifton, VA 22024

William Camack
USDA/FAS/EC/PDD
Room 4509 South Building
Washington, D.C. 20250

Virgilior R. Carangal
904 Brookwood Drive
Raleigh, NC 27607

Ginny Caye
Pennsylvania State University
Weaver Building, Room 204
University Park, PA 16802

Dick Cobb
AID/PM/TD
Room 435, SA-14
Washington, D.C. 20523

Robin Comfort
AID/DS/RAD
Room 506, RPC
Washington, D.C. 20523

Cynthia L. Connolly
USDA/OICD/ITD
Room 3541 South Building
Washington, D.C. 20250

John Conje
AID/ASIA/TR/ARE
Room 606, SA-18
Washington, D.C. 20523

Pierrette Countryman
USDA/OICD/DPMC/TA
1304 Auditors Building
Washington, D.C. 20250

Dana Dalrymple
USDA/OICD
3918 South Building
Washington, D.C. 20250

Johannes Delphendahl
Winslow Hall
University of Maine
Orono, Maine 04469

Brain D'Silva
USDA/ESS/IED
Room 373A, GHI Building
Washington, D.C. 20250

John M O'Sullivan
Center for Rural Development
Tuskegee Institute
Tuskegee, Alabama 36088

A.J. Dye
USDA/OICD/TAD
104 PP
Washington, D.C. 20250

Corwin V. Edwards, Jr.
USDA/OICD/TAD
104 PP
Washington, D.C. 20250

Rollo Ehrich
AID/DS/AGR
403RPC
Washington, D.C. 20523

Jerry Edwards
USAID/Manila
APO San Francisco 96528

Evert Everson
c/o Box 3567, EMCIP
Los Cruses
New Mexico 88003

Don Ferguson
USDA/OICD/TAD
106PP
Washington, D.C. 20250

Jerome French
AID/DS/RAD
Room 508, SA-18
Washington, D.C. 20523

Astolfo Fumagalli
7 Calle 30-43
Zone 11
Guatemala City
Guatemala

Daniel Galt
University of California
719 2nd St.
Suite 15
Davis, CA 95616

James Gifford
USDA/SEA
Southern Central Small Farms
Research and Extension Center
P.O. Box 85
Booneville, AR 72927

195

Elon Gilbert
University of Colorado, Boulder
International Economics Study Center
Campus Box 256, Economics Bldg.
Boulder, Colorado 80309

George Gardner
AID/NE/TECH/SA
Room 6664 NS
Washington, D.C. 20523

Michael Goldman
USDA/OICD/TA/N
1304A Auditors Building
Washington, D.C. 20250

Nancy Gray
AID/AFR/DR/ARD
2941 NS
Washington, D.C. 20523

Abdel-Salam Gumaa
Mohy Abul
E33 - Dokki
Cairo, Egypt

John Haberson
AID/DS/RAD
506 RPC
Washington, D.C. 20523

Albert R. Hagan
University of Missouri
Mumford Hall, Room 319
Columbia, MO 65201

Allen Hankins
AID/ASIA/TR/ARD
Room 606, SA-18
Washington, D.C. 20523

Art Hansen
470 Grinter Hall
Department of Anthropology
University of Florida
Gainesville, FL 32611

Wilmer M. Harper
Department of Agricultural Economics
New Mexico State University
Cruces, NM 88003

Larry Harrington
c/o CIMMYT
Londres 40
Apartado Postal 6-641
Mexico 6, DF
Mexico

Richard Harwood
Organic Gardening & Farming Research Center
RR #1
Kutztown, PA 19530

Patrick Haughney
USDA/OICD
1304 Auditors Building
Washington, D.C. 20250

Peter Hildebrand
Department of Food and Resource Economics
University of Florida
Gainesville, Florida 32611

Jeff Hill
University of California, Davis
Veihmyer Hall
David, CA 95616

William S. Hoofnagle
USDA/OICD
104PP
Washington, D.C. 20250

Nadine Horenstein
USDA/ESS
Room 390, GHI Building
Washington, D.C. 20250

Glen Howze
Tuskegee Institute
Tuskegee, Alabama 36088

John Hyslop
USDA/OICD/TAD
104PP
Washington, D.C 20250

James Johnson
USDA/ESS/CRIES
Room 303
Manley Miles Building
1405 South Harrison Road
East Lansing, MI 48823

Richard Johnson
AID/ASIA
Room 3208A NS
Washington, D.C. 20523

Michael Joshua
Virginia State University
Petersburg, VA 23803

Thomas F. Kelly
USDA/OICD/ISEC
3047 South Building
Washington, D.C. 20250

Howard Kerr
Coordinator, Small Farms Research
Northeast Region
Room 230, Building 003
Beltsville Agricultural Research Station
Beltsville, Maryland 20705

Merlyn Kettering
USDA/OICD/DPME/TA
Room 1304 Auditors Building
Washington, D.C. 20250

Stan Krause
AID/AFR
5417 N. 31st Street
Arlington, VA 22207

David Kunkel
USDA/FAS/EC
4509 South Building
Washington, D.C. 20250

Samuel Leadly
Pennsylvania State University
Weaver Building, Room 204
University Park, PA 16802

John Link
USDA/ESS/IED
Room 302 GHI
Washington, D.C. 20250

Nicolaas Luykx
AID/NE/TECH
Room 6484 NS
Washington, D.C. 20523

Jayne MacLean
USDA/SEA/TIS
Room 302 NAL
Beltsville, MD 20705

Porfirio Masaya
via ORD, James Bleidner
APO Miami, Florida 34024

Robert McColaugh
USAID/ROCAP/San Jose
AmEmbassy
APO Miami, Florida 34020

Ralph McCracken
Associate Director, SEA
302A Administration Building
Washington, D.C. 20250

Jerry McIntosh
CRIA/IRRI
P.O. Box 107
Bogor, Indonesia

Raymond E. Meyer
USDA/ASD
Room 2239 NS
Washington, D.C. 20523

Duncan Miller
AID/DS/RAD
Room 506, SA-18
Washington, D.C. 20523

Felipe Manteiga
AID/LAC/DR/RD
Room 2242 Main State
Washington, D.C. 20523

Richard Moraski
USDA/SEA/OMDS
Room 449, Federal Building #1
Hyattsville, MD 20782

Wendell Morse, Jr.
AID/AFR/DR/ARD
2941 NS
Washington, D.C. 20523

Bela Mukhoti
USDA/ESS/IED
Room 398, GHI Building
Washington, D.C. 20250

Thomas Murray
USDA/OICD/DPMC/TA
1304 Auditors Building
Washington, D.C. 20250

Hassan Nadar USDA/OICD
Box 201
APO New York 09675

Luis Navarro
CATIE
Turrialba
Costa Rica

William V. Neeley
USDA/SEA/Extension
Room 6818 South Building

Ray W. Nightingale
USDA/ESS/IED
Room 398, GHI Building
Washington, D.C. 20250

Maureen Norton
AID/ASIA/DP
Room 3208 NS
Washington, D.C. 20523

Ramiro Ortiz
University of Florida
Institute of Food and Agricultural Sciences
1125 McCarty Hall
Gainesville, FL 32611

Samsundar Parasram
CARDI Project
University Campus
St. Augustine
Trinidad, West Indies

Eugene Philhauer
AID/ASIA
329 11th St., S.E.
Washington, D.C. 20003

Donald Plucknett
CGIAR, IBRD
Room D1031
1818 H St., N.W.
Washington, D.C. 20433

Gordon R. Potts
IDRC
Box 8500
Ottawa, Canada
KIG 349

John Putman
USDA/ESS/CRIES
Room 303, Manly Miles Building
1405 Harrison Road
East Lansing, MI 48823

Edgardo Quisumbing
77 Second Ave.
Caloocan, Philippines

Alden Reine
Special Deputy Administrator
USDA/AR/SR
701 Loyola Ave.
P.O. Box 53326
New Orleans, LA 70153

Richard Róbbins
North Carolina Agricultural and Technological State University
Greensboro, NC 27411

Thyrele Robertson
USDA/OICD 4112 Auditors Building
Washington, D.C. 20250

John Rogers
USAID Mission/Cairo
Department of State
Washington, D.C. 20523

David Rohrbach
USDA/OICD
104PP
Washington, D.C. 20250

Hugh Rouk
Office of International Programs
221 USDA Building
Oklahoma State University
Stillwater, Oklahoma 74074

John Russell
IBRD, Room D814
1818 H St., NW
Washington, D.C. 20433

Susan Schayes
USDA/FAS/EC/PPD
4509 South Building
Washington, D.C. 20250

Susan Scurlock
USDA/FAS/ASIA
Room 4506 South Building
Washington, D.C. 20250

Dempsey Seastrunk
Texas Agricultural Extension Service
The Texas A&M University System
College Station, Texas 77843

Willis (Bill) Shaner
c/o College of Engineering
Colorado State University
Fort Collins, Colorado 80523

Abdel-Rahim Shehata
Mohy Abul
E33 - Dokki
Cairo, Egypt

Morris Solomon
USDA/OICD/TA/DPMC
Room 1304A Auditors Building
Washington, D.C. 20250

Lyle Solverson
Department of Agri-Business
Southern Illinois University
Carbondale, Illinois 62901

Gloria Steele
AID/AFR/DR/ARD
Room 2941 NS
Washington, D.C. 20523

Anthony Stellato
AID/DS/RAD
Room 506 RPC
Washington, D.C 20523

John Swanson
AID/NE/Tech
Room 6484 NS
Washington, D.C. 20523

Norman Ulsaker
AID/DS/AGR
Room 403E RPC
Washington, D.C. 20523

George Waldman
USDA/OICD
3047 South Building
Washington, D.C. 20250

Josephene Wallace
USAID/ROCAP/San Jose
APO Miami 34020

W. Phillip Warren
LAC/DR/RD
Room 2239 NS
Washington, D.C. 20523

Robert Waugh
c/o IICA
Apartado 1410
Tegucigalpa DC, Honduras

Michael Weber
Economics Department
Michigan State University
East Lansing, MI 48824

John Werst
USDA/FmHA
4134 South Building
Washington, D.C. 20250

Quentin West
Director
USDA/OICD
Room 143W Administration Building
Washington, D.C. 20250

Pat Wetmore
USDA/OICD/TA/WP
Room 3918 South Building
Washington, D.C. 20250

John R. Wilson
DSB/AGR
6701 Kenmont PL
Springfield, VA 22152

Bill Wright
International Agricultural Development
Service
1133 Avenue of the Americas
New York, NY 10036

John Yohe
AID/AGR
Room 411D, SA-18
Washington, D.C. 20523

Ruth K. Zagorin
USDA/OICD
Room 3049 South Building
Washington, D.C. 20250

Bernie Zandstra
Michigan State University
Department of Agricultural Economics
East Lansing, MI 48824