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# Global Review of Farming Systems Research & Extension Activities

## *A Results Inventory Based on Secondary Sources*

Office of Arid Lands Studies
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# GLOBAL REVIEW OF FARMING SYSTEMS RESEARCH AND EXTENSION ACTIVITIES

## A RESULTS INVENTORY BASED ON SECONDARY SOURCES

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Table of Contents

Introduction . . . . . 1

Brazil . . . . . 3

Burkina–Faso . . . . . 4

CARDI (Caribbean Research and Development Institute) . . . . . 5

Costa Rica . . . . . 6

Ethiopia . . . . . 7

Guatemala . . . . . 8

Lesotho . . . . . 10

Mali . . . . . 12

Nepal . . . . . 14

Niger . . . . . 16

Nigeria . . . . . 18

Panama . . . . . 19

Paraguay . . . . . 21

Philippines . . . . . 23

Somalia . . . . . 24

Swaziland . . . . . 27

Thailand . . . . . 28

Tanzania . . . . . 29

Zaire . . . . . 31

Zambia . . . . . 33

Zimbabwe . . . . . 37

References . . . . . 39

# INTRODUCTION

In the Secondary Review we initially intended to look at farming systems projects and programs that had been in place for at least five years in countries in Africa, Asia and Latin America. An initial list of countries to be covered was compiled. Much of that list overlapped with countries that had been reviewed by Kerry Byrnes in the Center for Development Information and Evaluation (CDIE) synthesis of USAID–funded FSR\E projects. We replicated a few of those: Lesotho, Zambia, ROCAP/CATIE, Ecuador, Guatemala, Tanzania, and the Philippines, supplementing his USAID document–based analysis with other documentation available to the KSU Farming Systems collection.

Because Byrnes' work was so extensive and complete, and because his work focused on USAID–funded projects, we used the Kansas State University Farming Systems collection to identify additional projects in other countries, often involving other funders. Unlike the USAID documentation system, which includes project papers, midterm evaluations, etc., the KSU collection contains primarily documents written by farming systems practitioners. As a result, these documents were incomplete regarding much of the information we sought. We found that some of the projects, which were relatively well described, had not been in the field long enough to bring forward results. Rwanda, for which we have good documentation, was omitted for this reason.

We found many excellent descriptive studies of FS sites with proposed recommendations. These descriptive studies included little about the projects themselves, but described the project area in great detail. These documents, as well, could not be used in our analysis, valuable as they are for farming systems practitioners.

Some diverse and long–standing farming systems research projects, such as that in northern Nigeria, were not used, although another, newer farming systems project in Nigeria is summarized.

Many papers do a brilliant diagnosis and announce what should be done, but do not indicate whether those recommendations were attempted or with what concrete results. These papers, which have an important use in guiding project activities, often are published in such journals as Agricultural Administration or appear in conference proceedings. They are useful to practitioners but were not helpful to us in our inventory.

We do not include in our results inventory recommendations resulting from on–farm trials or diagnosis unless they were implemented.

Much of the published work and fugitive literature document problems faced and solutions attempted at various points in the farming systems research process. This, too, is valuable to practitioners but did not contribute to our results inventory. While those are not results per se, they are a major and valuable part of the literature.

Indeed, farming systems research seems to be one of the few applied sciences that is willing to confess its failures in the hopes of correcting them. Because the process is a dialectical one, constantly undergoing feedback and adjustments, no project or program is set in concrete. It is perhaps that openness to admit and to document what did not work as well as what did work that has contributed to the denigration of farming systems research in some circles.

We looked at projects funded by a variety of sources, including international

research centers, major foundations and a number of governmental units, such as the Canadians and the Germans. It became clear that the longer the trajectory of funding, the more adaptations the farming systems project could make.

Many of the data on the projects were incomplete. Often researchers are reluctant to give full details of project structures. For this reason, the work that is coming out by International Service for National Agricultural Research (ISNAR) will prove particularly useful. We had access only to the ISNAR Zambia report.

What we present are incomplete synopses of project impacts built on documents that were written not to contribute to the inventory but to inform others who are attempting the farming systems enterprise. They reveal how researchers worked in a variety of administrative, agroecological and social conditions to attempt to increase the agricultural welfare of limited resources of farm families.

Causality is difficult to attribute in such cases. We present what is occurring in the country at the same time that the project is being implemented. Often the covariation does not mean causality. Factors other than project success might make a Ministry of Agriculture open to a farming systems approach in general and allow the farming systems project to become institutionalized. Extra project phenomena often influence the dissemination of results and policy impacts. Thus, the part of each project description labeled "impact" must be taken with the caveat that this may not necessarily be attributable to the project, but is occurring at the same time.

Social causality is difficult to demonstrate and to document. Perhaps the most documentable impact has been that we can show specific cases where experiment station researchers have changed their research agenda in response to farming systems diagnosis or on-farm trial results. Although changing a research agenda to be more in tune with the needs of limited resource farm families is important, it is not as spectacular as doubling maize output or eliminating an aphid investigation.

## Brazil

### Project Overview

The Agricultural Research Center for the Semi-Arid Tropics began in 1975 and is funded by the Brazilian government. Its functions include: 1) evaluation of the natural and socioeconomic resources of the rural environment to assess traditional farming systems, their boundaries, limitations and potentials; 2) analytic research, carried out on experiment stations; 3) synthesis experiments, comprising an integration of different disciplines; 4) experimental farming systems, undertaken on site, involving all farming systems components; 5) introduction of improved farming systems among farmers in different agro-ecological situations; 6) and testing (validating) isolated technologies on farmers' fields for feedback to the improved farming systems.

### Constraints

Production costs were high and capital availability was low. Farmers did not adopt recommended technologies. Erratic rainfall and overgrazing made agriculture and crop production extremely risky. There was an initial reluctance of researchers and extension staff to work together.

### Impact

Interdisciplinary teams were created within the Center.

The success of the teams led to the spread of the FSR/E approach throughout EMBRAPA's cooperative research network in the Northeast.

The Federal University at Paraiba began working with the Agricultural Extension Enterprise of Paraiba (EMATER), the Agricultural Research Enterprise of Paraiba (EMEPA), and the Cotton Research Center of the Brazilian Agricultural Research Enterprise (CNPA/EMBRAPA) in a farming systems approach to extension and research.

New technologies of water harvesting and pasture management were introduced in cooperation with rural villages.

## Burkina--Faso

### Project Overview

The Purdue/SAFGRAD (Semi--Arid Food Grain Research and Development project) Farming Systems Research Project began in 1979 and continues to the present. USAID and the International Institute of Tropical Agriculture (IITA) funding attempted to develop the research and development capacity of Burkina–Faso to produce food grains. It included a Farming Systems Unit (FSU). Water conservation and soil fertility were among the themes addressed by the FSU. Linear program modeling, a farmer survey on the adoption of new technologies, and farmer interviews accompanying field trials were carried out.

### Constraints

Farmers were not adopting recommended technologies. Low rainfall and low soil fertility resulted in low yields per hectare. There was a lack of access to the institutions supplying inputs and credit.

### Impacts

The FSU successfully used whole–farm modeling to determine policy implications. One such determination was that the promotion of appropriate animal traction equipment, improved roads, and dissemination of market information led to higher prices and therefore was more effective than the introduction of land–substitution inputs.

Diagnostic results were used to influence research, leading to the development of a mechanical device to tie ridges.

Through the FSU, SAFGRAD became part of the national farming systems on–farm field program of Burkina–Faso.

The diagnosis also influenced extension and research by specifying the kind of research requirements and specifying extension recommendations according to soils, access to animal traction, and access to credit.

Burkina–Faso is part of the West African Farming Systems Research Network (WAFSRN).

# CARDI
## (Caribbean Research and Development Institute)

### Project Overview

The Farming Systems Research and Development Project at the Caribbean Research and Development Institute (CARDI) began in 1978.

The Farming Systems Research and Development Project (FSR/D) is funded through CARDI core funds and USAID. The project serves eight Island Nations in the Caribbean: Antigua, Barbados, Dominica, Grenada, Montserrat, St. Kitts/Nevis, St. Lucia and St. Vincent. It was proceeded by a cropping systems project that allowed CARDI to hire staff and to begin many of the activities that became part of the FSR/D projects. The project's goal is to improve the economic and social well-being of small and medium-sized commercial farm households. The primary purpose of the project is to develop a sustainable FSR/D program with CARDI that is responsive to the agricultural research needs of the eastern Caribbean. The project's expected outputs are: 1) alternative crop, livestock and crop/livestock technology, 2) a methodology to generate and transfer technology, and 3) the institutional capability to implement FRS/D projects.

### Constraints

Relatively low incomes and high male migration, as well as poor soils and limited markets were constraints of concern in the islands.

In the first phase of the project there was a lack of adequate support for management. The project also experienced cash flow and financing problems.

### Impacts

Training of researchers, administrative and extension personnel through multiple objective workshops has been institutionalized.

A collection of a crude variety of crops from many of the International Centers and from FAO of the United Nations has become available.

The project helped CARDI establish contact with the International Centers in Nigeria and India.

The project installed and FSR/D management system that further linked research and extension in the Caribbean.

CARDI has made a strong commitment to decentralize its research and to mount a client-oriented program at the country level.

A methodology for modeling system innovations was developed and used to improve existing farming systems.

The methodology was applied in Dominica to expand the number of on-farm enterprises (to include raising elephant grass and cattle in confinement), which in turn influenced on-station research to study manure storage and management for vegetable production.

## Costa Rica

### Project Overview

The Small Farmer Production Systems (SFPS) in Costa Rica grew out of a 1979 cooperation agreement between the USAID Regional Office for Central America (ROCAP) and the Tropical Agriculture Research and Training Center (CATIE) in Costa Rica. In 1983, the initial four-year project was recommended for an extension of two years. This increased the grant to 8 million dollars including funds for field operating expenses, as well as for short-term and M.S.--level training.

The objective of the SFPS was to develop an applied research methodology for the generation of alternative agricultural technologies within the framework of FSR/E. The project sought to help small farmers of the Central American region to develop more productive and balanced cropping systems that would provide better nutrition and food security for the family and yield a greater surplus for higher family income.

Three line-programs were considered during the development of SFPS: a) crop systems, b) animal production, and c) mixed farming systems. The objective of the program was to put together alternative, more productive systems for small animal and crop production.

A general seven-step methodology was developed by the staff during their field work: a) area selection, b) characterization of the zone, c) design of alternative technological "packs," d) farm experimental trials managed by the research team, e) validation of the technological alternatives by farm-managed trials, f) diffusion to small farmers and g) continuous monitoring of selected farmers in order to reformulate the implemented technological alternatives.

### Constraints

The national institutions of research and extension were relatively weak and not well articulated with each other. There was a tendency to centralize planning and decision-making. Productivity was relatively low. There was a low level of leadership skills and no national network.

The project's transference process was weak, as it was shaped by CATIE methodological emphasis on the validation of the technology rather than its acceptability by the farmers. The "tech pack" sometimes required drastic changes in the distribution and use of such resources as labor force and inputs. There was a low rate of acceptability.

Each project had its own financing and staff. There was little continuity among projects.

There was little communication between the research team and the farmers with respect to the information gathered. The criteria used for characterizing the regions and communities left out important sociocultural variables. Farmers were excluded from the process of technology generation.

The generation of alternative technologies emphasized each subsystem rather than the whole production process; it did not take into consideration the "linking resources" that exist between the subsystems. The recommendations made were not necessarily

suited for the whole system, its resources and requirements.

The SFPS team was relatively isolated from the current developments in FSR/E. Further, there was little integration with pre-existing government agricultural institutions.

Impacts

A cadre of high-level professionals and technicians were trained. Nineteen Central American FSR/E related professionals received M.S. degrees.

The project conceived and implemented a training program for extension workers. More than 1,500 people participated in a variety of short courses and workshops.

The methodology developed by the Instituto de Ciencia y Tecnologia Agricolas (ICTA) resulted in generating productive technological alternatives. These technological alternatives had varying degrees of success in maize, sorghum, beans, etc.

As the project was ending, some of the regional governments started developing complementary activities and allotting money for FSR/E.

Forty percent of the SFPS sites in the region continued involvement in FSR/E after the project funding ceased.

## Ethiopia

### Project Overview

Farming Systems Research in the Institute of Agricultural Research is funded by the International Development and Research Center (IDRC) and the World Bank.

The Institute of Agricultural Research (IAR) is a semi-autonomous public organization undertaking and coordinating agricultural research in Ethiopia. The first multidisciplinary survey to identify farmers' problems as perceived by farmers occurred in 1977-78. Diagnostic surveys and on-farm experiments started in the 1984-85 crop season at two research centers and were gradually expanded. By 1986-87 the Agricultural Economics in Farming Systems Research Department (DAEFSR) had programs at seven major research centers located in five of the eight agricultural development zones in the country. The goals of this research are to increase the productivity of small farmers through increasing their rates of technology adoption and to create technology that fits farmers' needs and circumstances.

### Constraints

The erratic nature of rainfall, the presence of many pests, familiy food shortages prior to the maize harvest are all problems. There are dry season feed shortages for livestock. Labor bottlenecks occur at key times in the production cycle.

There is a shortage of agronomists and animal production specialists. Because the Agronomy and Animal Production departments keep these specialists in their departments, they are not able to participate as members of on-farm research teams. Links have not been made with policymakers. The division of labor between DAEFSR and other departments was not defined in ways that took advantage of the best type of collaboration.

### Impacts

After identifying farmers' major constraints to be in sorghum production, 22 varieties were tested on farmers' fields (screened down to 5). In 1987, the variety appreciated most by farmers was approved for release. Qualities that led to its preference were: low susceptibility to bird damage, early maturity, and high yields.

On-farm testing of the tied-ridge system to conserve soil moisture was modified on-station in order that small farm implement researchers would develop appropriate tools for tie ridging, thus overcoming the labor constraints identified in on-farm trials.

Early maturing maize varieties that avoid moisture stress were tested and recommended for one area where they were highly accepted. These replaced the long-cycle local maize cultivars that have experienced recurrent crop failure due to changing weather patterns.

Producer cooperatives and some individual farmers have adopted row planting of corn to increase ease of weeding.

Feedback from surveys on on-farm haricot bean trials is leading to new research thrusts and proposed modification of current recommendations.

On-station experiments are being varied as a result of surveys and on-farm trials.

In another zone, short-cycle varieties are being developed as a result of the diagnostic surveys.

The DAEFSR staff is collaborating with the animal feed and nutrition department as well as commodity research coordinators.

Research center managers are insisting that scientists work together in diagnosing problems and implementing on-farm trials.

There is a consensus in IAR that new technologies should always be verified on farmers fields before they are recommended for use.

Research-extension liaison committees have been formed and are helping to develop research programs.

A seven-year test of component packages was carried out on the fields of individual farmers, cooperative farms, and communal peasant associations.

The researchers dropped fertilizer and insecticide recommendations and trials in response to farmers' assessment that costs were too high and risk of crop failure too great for fertilizer, and there was not the cash or labor to apply insecticide.

Farmers at one research center were divided into two recommendation domains based on their access to inputs, institutional support, crop management, and differences in development opportunities. This division differentiated producer cooperatives from individual farmers. Technologies were modified to suit each group's institutional and economic circumstances.

## Guatemala

### Project Overview

The Food Productivity and Nutrition Improvement Project (FPNI), a five-year project, was approved by USAID in 1975. The Rockefeller Foundation funded a socioeconomic team to study farmers' decision-making processes and rationale. FPNI was implemented by the Agricultural Science and Technology Institute (ICTA) of Guatemala. ICTA's primary function was to generate and promote the use of technology in agriculture, particularly within the small farm sector, in order to improve the standard of living and to increase food production at the national level toward the goal of food self-sufficiency.

The FPNI goal was to improve the quality of life of rural Guatemalans by increasing the quantity and nutritional quality of food available for consumption, and by increasing small-farmer incomes in the process. The project methodology was based on four basic premises: a) analysis and understanding of the principal bottlenecks of farmers' production systems, b) farmers' participation in the research-generation process, c) incorporation of farmers' criteria, and d) generation and validation of technology at the farm level.

Although ICTA did not define its methodological approach as an FSR/E, during its implementation those principles were present. The project was successful in developing an FSR/E approach within ICTA.

Subsequently, the modular model of technology transfer was developed. The model is comprised of four levels: a) the institutional nucleus, b) a technician who is in charge of a local technology-testing and transfer team, c) a promoter in charge of ten rural leaders; and d) an organized group of twenty farmers who conduct the field trials and transfer process on their own farms.

### Constraints

Over 50 percent of the rural families in the target areas spoke Spanish. The indigenous population was extremely isolated, with few access roads or other means of communication. The non-Spanish speaking population was extremely poor.

There was little coordination among the various agencies concerned with agricultural development. Funding for the total governmental budget for the agricultural-technological sector was less than 1% of the total internal agricultural product.

There was little interaction between the socioeconomic team and the other groups in the project. Much of the information gathered was underutilized in developing technological alternatives and their transfer.

The socioeconomic unit lost a significant number of trained professionals due to ICTA's administrative problems (i.e., low salaries). The project, in general, was not able to retain its staff, and a permanent outflow occurred.

Finally, although governmental support remained during the 1981-84 period, the budget allocation decreased, jeopardizing ICTA's efficiency.

Impacts

Since its creation in 1973, ICTA has attracted support from different sources, including governmental funds. Also, it generated some resources from the sale of services and goods (seeds).

The FPNI project developed improved varieties of corn, sorghum, and beans and made them available to small farmers.

A technology demonstration program for high quality vegetable production was created.

A professional research/extension staff was trained.

The project provided professional training and short courses for technical and extension personnel. As a result of these programs, the initial lack of national specialists at the Ph.D. and M.S. levels was diminished, and hundreds of technicians were trained.

The project was successful in establishing within ICTA an institutional capability to carry out technology development.

The project developed multidisciplinary "units" that worked together in the field programs. These units were organized into commodity–line teams that worked across the country with the cooperation of a socioeconomic unit.

According to ICTA, the model developed by the FPNI played an important role in the increased production of several crops (such as maize, wheat, beans, and sorghum, among others) by generation of seed varieties with high productivity and resistance to environmental factors. The impact evaluation notes that the project "provided a key input to the development of improved varieties and of a privately controlled seed industry."

The model increased the participation of farmers in the technology transfer process.

To assess the technology transfer process the project developed an acceptance index that represents the percentage of collaborators continuing to use the recommended technique in the year following the farm test, multiplied by the percentage of the farmers' land on which the technology is applied.

An increasing number of farmers were adopting the technologies developed, although the degree of acceptance was not considered adequate.

## Lesotho

### Project Overview

The Lesotho Farming Systems Research Project (LFSRP) lasted from 1979 to 1986. Its purpose was to create more productive agricultural enterprise mixes that were acceptable to farmers, sensitive to farmers' management abilities, appropriate to resource availability, and protective of the land base. It was to do this by assisting a newly established Research Division of the Ministry of Agriculture to conduct agriculture research on farm enterprise mixes.

Technical assistance, training, commodities, and construction were provided. An extension element was included in the project to develop effective means to reach farmers and to gain their understanding and acceptance of the practices recommended.

### Constraints

Problems existed in the conceptualization of the project and in its reasonable expectations. Major bureaucratic difficulties existed in developing linkages between researchers, extension workers and policymakers. It was unclear whether the intent of the project was to reach a few areas that were specifically delimited or to transform the research and extension approach of the entire country. The initial expectations were artificially high.

Standard crop production recommendations were not published. There were limited data recording the actual farming systems and the availability of inputs. The project administrators assumed that the appropriate technology existed, despite the fact that farmers did not initially adopt the technologies of agronomic, range management, and livestock practices recommended by the project.

There was no agreement on the goal of technical assistance. Data collection methods were overly time-consuming and extensive.

There was a low initial institutional capacity within Lesotho. Very few trained individuals were available. Coordination of training was mismanaged.

This project raises the question of whether countries with scientists of only B.A.-level or below can do anything beyond adaptive on-farm research with a farming systems orientation.

There was conflict in expecting the farming systems project to come with up solutions for the entire country.

The LFSRP shared the constraints of many large first generation farming systems projects. It was poorly conceived and designed, in part because of the fragmentation of approaches to farming systems when the project was initiated. The project was not staffed by experienced farming systems practitioners, in part, because few were available.

### Impacts

A farming systems approach was integrated into the Research Division of the Ministry of Agriculture.

On-station introduction trials were linked to on-farm trials and extension activities.

Farmers were involved through Village Agricultural Committees in field testing crop technology as well as in demonstration plots.

Farmers' groups spontaneously organized to visit on-farm trials in other prototype areas.

Training in farming systems methodologies was regularly held for extension field workers and for Village Agriculture Committees.

Village Agriculture Committees were used in various parts of the country to provide input for research and extension as well as to serve as a conduit for research results and extension information.

Women were increasingly involved in extension efforts and in diagnostic surveys. They also participated in programs to increase fertilizer use, to plant improved seed, to initiate rotational grazing, and to control gully erosion.

A systematic mechanism for publishing research and trial results was established.

The Research Division is part of the CIMMYT Farming Systems Network group.

Interdisciplinary work will continue involving range management, farm management, rural sociology, marketing, and extension/communication in gathering data.

Farmers in the project areas adopted several of the technologies that were developed and recommended.

These technological innovations were diffused to nearly 2,000 people.

The Research Division was responsive to farmers' problems and forged excellent linkages to farmers in community groups. It carried out adaptive research in farm management marketing, rural sociology, and extension with farmers' participation.

The bureaucracy has proven flexible in its response to learning experiences. After an evaluation, the separate FS unit was abolished in favor of strengthening the entire Research Division.

Lesotho achieved considerable linkage coordination and involvement of extension in its farming systems research effort.

FSR personnel suggested legislation to limit livestock imports except in the case of improving genetic quality and to reduce overgrazing. These measures were implemented.

## Mali

### Project Overview

The Farming Systems Research and Project/Division of Research on the Systems of Rural Production (DRSPR) began in 1979 and continues to the present. Funding comes from IDRC, USAID and the Ford Foundation. FSR & D in Mali was initiated in 1979. Until 1985 it focused on the country's major production zone for rain-fed agriculture, Mali-Sud. Cotton is the major commercial crop in that area; maize and farmers' subsistence crops are also grown. The dominant focus had been on crops for export. Thus the Extension Service, which is active in that area, has primarily dealt with large farmers. Farming Systems Research is carried out by the Institute for Rural Economies (IER) under the Ministry of Agriculture which is responsible for agricultural research in Mali. A separate farming systems division, DRSPR, was created in 1979. Commodity research is the responsibility of the Agronomic Research Division of IER. The goals of the project have been to further link extension with research and to broaden the work of extension workers from cotton to the other crops grown by farmers in the area in order to improve farmers' welfare.

### Constraints

The traditional subsistence farming pattern of shifting-burn agriculture is not able to feed an increased population. Because of a high-risk situation and the crop failure associated with previous technologies introduced, farmers were very cautious in adopting new technologies. A major problem is the preoccupation of extension workers with cotton production. Other constraints included the inward-looking attitude in the extension service and a noticeable reserve vis-a-vis other government organizations. The diagnosis phase was perhaps too extended. Poor agro-climatic and infrastructural conditions existed. Disease decimated the work oxen in some villages. Alternative work opportunities drained labor from agriculture in the target areas.

### Impacts

Farming systems researchers, commodity researchers, and development agency personnel meet annually to share research results.

Commodity research and FSR are coordinated by a committee of staff from both divisions which meet regularly to discuss collaboration and to exchange information on research and technology.

The FSR division invites researchers from other divisions to carry out necessary special studies for its research.

A budget line is available to facilitate collaborative research.

The research station, run by the Farming Systems Division, makes available facilities for commodity and discipline-oriented research.

The FSR division evolved a policy to involve the development agency (extension) in every stage of research.

The Development Agency staff is trained in FSR through seminars, training sessions, field days, and on-the-job training.

Every technology proposed is evaluated in terms of its technological, economic, and institutional feasibility.

The research division has instituted a policy requiring every new researcher to spend as much time as possible in the field with responsibility for implementation of on–farm tests and special studies with farmers.

An institutional mechanism was developed giving the FSR division direct access to the higher officers of the development agency.

A long–term view on agriculture in the area was developed and serves as a guide for important research policy choices.

An officer in the development agency was made responsible for the linkage between research (commodity and FSR) and development extension.

Extension research themes have been constantly defined, redefined and dropped in response to ongoing FSR.

The FSR team influenced the organizational and financial conditions of a large–scale credit scheme to provide work oxen to small farmers. It established an area erosion control unit within the extension service.

The FSR team reinforces extension's work with women farmers.

Farmers have increased their participation of maize using manure and compost in the Bougonni–Sikasso area.

## Nepal

### Project Overview

The Nepal Cropping Systems Program began in 1977 funded by the International Rice Research Institute (IRRI) and International Development Research Centre (IDRC). In 1977, the Integrated Cereals Project (ICP), in collaboration with the Agronomy Division of the Department of Agriculture, began a cropping systems research program, following the IRRI methodology. The cropping systems program implemented a novel approach to identify proven crop production technologies in several well-defined socio-agro-climatic situations in Nepal. This approach brings together biological scientists, social scientists, and farmers to work together as a team in farmers' fields to identify improved practices to increase crop production and agronomic well-being. After developing a thorough understanding of the conditions that exist within the area encompassed by the cropping research site, research trials are designed and implemented with full participation of carefully selected farmers to test new innovations and to evaluate their utility. The research phase was from 1977 to 1980; from 1980-present the research and extension phase takes place. In 1985, attention was focused on small and marginal farmers. With the inclusion of livestock analysis in 1985 the cropping systems approach was broadened to a farming systems approach.

### Constraints

Although surrounded by irrigation channels, Sukchaina must depend on rainfall for crop production. Most farms are extremely small. Rice monocropping dominated over 50 percent of the area. Numerous local rice varieties were grown instead of improved varieties (identified as a constraint in the first survey in 1977). Labor bottlenecks occurred. Incomes were low. Soil fertility would not support multiple cropping. There were seasonal food shortages. While livestock was important in the farming system, its production was limited by the availability of feed, especially green forage and fodder. Extension tended to ignore the small and marginal farmers who predominated in the area. Early work focused solely on crops, ignoring the importance of livestock.

### Impacts

By 1981 in Sukchaina the area planted with improved varieties increased from 20 percent to 54 percent.

Between 1980 and 1984, 98 percent of the rice area in Sukchaina was planted with improved varieties, including a wider spectrum of improved varieties.

Farmers cooperating with the project became recognized as a source of rice seed of new high-yielding varieties in rain-fed conditions serving as a conduit for the improved seed to other regions of the country.

By 1984 most farmers applied nitrogen as both basil and top-dress nitrogen applications substantially increased rice yields in the zone. Rice yields increased by 45 percent.

Farmers shifted from the rice/fallow/fallow pattern to other more intensive patterns, such as rice/mixed-crops/fallow; the major component crops of the mixed cropping system were lentils, mustard, and linseed.

Much of the increase in cropping intensity resulted from the adoption of improved, early maturing rice varieties. This allowed farmers to spread out their peak work periods, particularly those associated with rice harvest and land preparation for winter crops.

The rice/chickpea–plus–mustard/fallow pattern was a major research contribution in Sukchaina.

A new chickpea variety that was high yielding and adapted to local conditions, combined with timely planting (in late October to early November after early maturing rice varieties), resulted in dramatic economic increases for farmers. This is especially important because this is a rainfed environment.

Considering the adoption of some improved crop varieties and use of fertilizer, small and marginal farmers were somewhat benefited.

Policy recommendations were made regarding crop insurance.

## Niger

### Project Overview

Funded by USAID, INRAN (Institute National de Recherches Agronomiques du Niger) was established in 1975 to carry out agricultural research. Beginning in 1977, a series of farming systems investigations were undertaken. In 1984, INRAN established working groups with an FSR orientation to accomplish the following goals: 1) to establish within INRAN a multidisciplinary team composed of researchers from different fields (biologists and economists) and extension agents; 2) to formulate research programs on farming systems and, after their execution by the multidisciplinary team, to evaluate the results and to generate feedback for future programs; and 3) to inform INRAN administrators of the progress achieved in these programs and to ensure administrative support for them.

### Constraints

Low rainfall, frequent droughts, sandy soils, and low and declining soil nutrient levels made food production difficult. The high cost of capital made any purchased technology extremely risky. A number of labor bottlenecks existed. There are no government-sanctioned rural credit institutions in Niger. The research/extension liaison is poor. Communication of progress and results does not flow directly from research to extension. Trials are poorly explained to extension agents, who must implement them. Many do not understand the differences between on-farm trials and demonstrations. The trials program has not led to changes in recommended farming practices. National policies and implementation procedures are imprecise, which confuses role definition and the allocation of technical responsibilities. Extension agents treat farmers in an extremely "top-down" manner, hindering communication.

### Impacts

Systematic analysis yielded three recommendation domains, which served as the basis for testing new technologies.

Early FSR research influenced commodity researchers to develop a millet variety with better tillering and a cowpea variety with better taste than the previously recommended varieties.

A multidisciplinary team was formed within INRAN; sondeos were carried out, and an on-farm trial program was elaborated.

A linear programming model was developed to evaluate the effects of labor availability and allocation or the choice crop technology.

The research agenda at INRAN was changed to include research on intercropping and on-farm verification of techniques developed on the research station before extension to farmers.

INRAN accepted the importance of a multidisciplinary approach by both researchers and administrators.

Niger is part of West African Farming Systems Research Network (WAFSRN).

The participation of administrators in the team's activities aided the rapid adoption of new directions.

## Nigeria

### Project Overview

The Bida Agricultural Development Project (BAFD) (1980–1985) was funded by the Federal Government of Nigeria, Niger State Government, and a World Bank Loan, with cooperation from the International Institute of Tropical Agriculture (IITA). Its objective is to raise agricultural production by 25 percent and to increase farm income by providing farm inputs such as fertilizers, credit, tractor hiring service, extension information, low–cost irrigation and construction of feeder roads. The project worked with IITA in agronomic research designed to identify major constraints in the local farming systems. The aim is to identify intervention points and to develop technologies and recommendations adapted to the needs of the local farmers, for use by the project's extension staff.

### Constraints

There are major problems in staffing, including the low level of technical knowledge by the current staff. The urban background of many of the scientists biased them against learning from the farmers. Another constraint was the lack of trained staff to carry out diagnostic farm survey and agronomic experimental work. The boom/bust aspects of the macroeconomic setting of the 1970s reduced Nigerian funds, but left an excellent transportation system and a positive climate to reorient agricultural policy toward food production. The agricultural credit system is underdeveloped.

### Impacts

The identification of areas of improvement through FSR/E methodology was institutionalized with the introduction of an effective and fast FSR/E diagnostic methodology.

As a result of research, the extension service introduced short–season cowpeas, which were widely adopted.

The FSR project coordinated with research institutes to test component technology and to identify those suitable for farmer adoption (including short–season cowpeas, serrated sickles, and increasing rice hill density).

Policy implications included identification of the need to undertake land development engineering work for the control of surface runoff and water seepage.

An exhaustive list of constraints directly facing farmers, combined with farmers' solutions to those constraints, was prepared. This list was a major influence on on–station commodity research and on integrated pest management research.

Five technical constraints and technologies to overcome them were mutually decided upon as research priorities by the OFR (On Farm Research) team and by individual commodity or crop improvement programs.

Contact and cooperation increased between the BAFD's commercial, extension, and research divisions through their mutual work with farmers.

Farmers' evaluations are now routinely incorporated into on–farm trial assessment. Training for field staff was carried out. Nigeria is part of WAFSRN.

## Panama

### Project Overview

FSR/E Project Caisan, Panama was funded by IDIAP (Panamanain Agricultural Research Institute) and CIMMYT (International Maize and Wheat Improvement Center), with additional support from CATIE (Tropical Agriculture Research and Training Center) and IDRC (International Development Research Center). Rutgers also participated by supplying a resident agronomist.

This project's goal was to improve the farming systems of low–resource farmers producing maize and beans in the Caisan area of western Panama. IDIAP and CIMMYT worked together. Informal surveys, formal surveys, exploratory trials, and follow–up surveys were used. IDRC funded a data management system based on the IBM PC and off–the–shelf spreadsheet programs.

### Constraints

There was a conflict of interest between the national and regional administrators and the management within the projects. Another problem was the inability of staff to work with the culture of the farmers in the area. There was a lack of experienced researchers. Technicians were not fully aware of the time required for various activities. Uncertain lines of responsibility and communication existed, because the national organization operates along discipline lines, while the regional organization is focused on geographic areas. This problem was exacerbated by social scientists coming from the Planning Department to the Research Teams, which were within the research departments. Uncertain budgets and cost over–runs added to the problems. Difficulty in communication existed since no phones or radios were available. Repeated trips to farms, inappropriate use of vehicles, and poor roads led to high vehicle maintenance costs. Contingency supplies were required due to distances. The support services such as photocopies, equipment, and repair were expensive. High transportation costs were constraints. Links with experiment stations were poor at first. In Caisan, extension agronomists continued to give fertilizer recommendations at odds with results of the validated on–farm trials, which showed additional nitrogen was unnecessary. There was poor linkage with other agricultural institutions.

Success of the project was due in part to the availability of tested techniques that were developed on experiment stations or that existed in the literature and were adapted to the small farm environment.

### Impact

To incorporate farmer innovations, the research design was modified as a result of the surveys.

There was a high adoption rate of the recommended technologies for maize.

There was high adoption of the field bean varieties recommended after on–farm testing.

The social rate of return to the project was calculated and found to be much greater than the amount invested by IDIAP.

The research agenda shifted because of the farming systems research diagnosis to refine alternatives in the area of soil fertility management.

IDRC funded a data management system based on IBM PCs and spreadsheet programs. Use of microcomputers and off–the–shelf software was so effective in Caisan that IDIAP invested in microcomputers for other projects in the area.

In Caisan the maize breeding program of the experiment station was influenced by the results of the diagnosis and on–farm trials.

Late in the project several agreements were worked out to link the project with the suppliers of inputs on the policy level.

The bank and extension staff are currently included in the actual research project.

On–farm research activities expanded throughout the country, including the identification of priority areas in crops and livestock.

## Paraguay

### Project Overview

Proyecto de Tecnologia para Pequenos Agricultores (PTPA) was funded by USAID, 1980 to 1985. PTPA was implemented with a farming systems approach that included a team of multidisciplinary specialists assigned to each of eight selected regions. The teams were to identify researchable problems and to implement that research with farmers' participation. Initial problems emerged as the researchers resisted working with extension and insisted on personally setting research priorities without regard to farmers' priorities. This changed when a consultation team from the FSSP (Farming Systems Support Project) arrived in June of 1983. A farming systems practitioner from ICTA (Agricultural Science and Technology Research Institute) remained as a full-time consultant for the project.

### Constraints

Early contracted research was arbitrarily motivated and inadequate in number and design. Antagonism persisted between the research and extension directors. Some inputs were difficult to obtain. Linkages between production-enhancing activities and marketing were lacking. No effective credit system was present for small farmers, who depended on extremely high interest loans from the private sector; public sector and cooperative credit was biased toward large farmers. Much of the data from early on-farm trials was not analyzed in a timely fashion. Formal surveys were incompletely carried out, with no impact on the project.

### Impacts

Coordination increased between researchers and extension.

The extension and research personnel received in-service training in FSR/E.

A sondeo methodology was designed and implemented.

Research was redirected toward farmers' self-defined priorities, particularly in production of maize, strawberries, and tomatoes.

Collaboration was achieved with experiment station researchers in these crops.

The number of well-designed on-farm trials increased.

## Philippines

### Project Overview

The Philippine Farming Systems Development Project in Eastern Visayas (FSDP-EV) was implemented in 1982 by the Region VIII Ministry of Agriculture and Food (now renamed Department of Agriculture) the Visayas State College of Agriculture (ViSCA), and Cornell University. Project funds from USAID included a $1,400,000 grant and a $1,600,000 loan. The Philippine government provided P2,813,000.

The first year of the follow-on phase, or Cycle II, under USAID and Philippine government funding, began in 1988. The project was extended three years to institutionalize the FSR/E approach in the regional department of agriculture and to extend site-tested technologies.

The objectives of the follow-on phase are to disseminate rainfed agricultural technologies to the resource-poor farmers in the upland areas in Region VIII; to strengthen the FSR/E mechanism; and, to institutionalize the FSR/E mechanisms in the RDA and in ViSCA.

The FSDP-EV is mandated to improve the well-being of the small subsistence farmers in the rainfed upland areas in the region. These farmers had not been beneficiaries of earlier agricultural research projects, which were directed in the lowland irrigated areas. The project seeks to establish a proven mechanism for adapting rainfed agricultural technologies to the resource conditions found in Region VIII and to disseminate appropriate technologies.

### Constraints

The project's initial work focused on researcher-managed varietal trials following traditional research-extension methodology, contrary to the FSR/E principle and practices.

An evaluation team in 1983 introduced major modifications. These included the introduction of expensive inputs such as fertilizer and pesticides (which the farmers obviously could not afford to purchase) the introduction of new crop varieties when farmers preferred to grow traditional varieties, and the introduction of new methods of planting.

The project initially followed a top-down approach in the design and implementation of cropping pattern trials. Farmer participation was weak. Labor was the farmers' only significant contribution. Farmers had an inadequate understanding of what project site staff were doing in their fields.

Adoption rates by farmers were poor. Inputs were costly, planting additional crops required more time and labor, and soil fertility was too low to support the introduced cropping pattern. In addition, drought, floods, typhoons, pests and disease, and stray animals made cash investment for the farmers risky.

Several factors that have impeded project success are: lack of communication and distance between the major actors, reorganization of the regional agricultural department, and the farmers' tenurial status.

The establishment of perennial cropping systems in the Philippine project was not widely adopted by the farmers because sharecroppers feared that they could be removed from the land at any time without receiving benefits from the crops they planted. Landowners sometimes discouraged the planting of crops when they were perceived as strengthening the tenants' potential claim to the land.

Impacts

FARMI, an interdisciplinary research program to sustain agricultural productivity in the uplands, was created at ViSCA in 1987 to institutionalize the participatory technology development approaches to agricultural research and development. FARMI serves as a link between the college, the regional department of agriculture, and the small farmers. FSR/E training programs are conducted at the trainees' locality.

The project has conducted several training programs/short courses on the FSR/E approach for its site staff.

The project has organized and supported farmer-to-farmer training programs in extension in upland technologies.

FARMI and the FSDP-EV conducted a consultative conference for agricultural school administrators on the FSR/E approach in 1988 to help link the RDA and the agricultural schools in the region.

One agricultural school requested the project conduct a mobile training in their locality.

FARMI and the FSDP-EV established linkages with the International Rice Research Institute (IRRI) at Los Banos, Philippines.

There have been various projects in the Philippines, which have influenced the government to attempt to institutionalize the approach. These projects included the National Multiple Cropping Production Program (NMCP), Rainfed Agricultural Development Project (KABASAKA), and the Agusan del Sur, Bukidnon, and Capiz (ABC) Resettlement Project.

The NMCP was successful in identifying the organizational structure necessary for the institutionalization of the FSR/E approach in agricultural research.

FSDP-EV has had a high level of host-country support and involvement, including active participation in the project design. Staffing for the project has included mainstream employees of high caliber. Farmer participation in the project has increased. The regional department of agriculture is attempting to institutionalize the FSR/E approach.

Interdisciplinary interaction increased as a result of the project, which brought together various disciplines both at the site level and in ViSCA.

Individuals from the Department of Agriculture and project staff participated in nondegree and degree training locally and abroad.

The project's flexibility allowed it to make a timely shift toward experimenting on low-input, sustainable interventions that address farmer-articulated problems.

In farmer–cooperator organization meetings, farmers and staff plan and decide local activities collectively. By institutionalizing the FSR/E approach in the regional Department of Agriculture, there is now a recognition that a bottom–up approach to research, based on the needs perceived by the farmers, is necessary. Farmers are given the opportunity to participate in the research and extension process.

The project is a catalyst in the institutionalization of the FSR/E approach. The project was used to test whether or not FSR/E would work under Philippine conditions. Five years of project implementation saw this potential in at least four ways:

(1) developing mechanisms that would help researchers, both on–farm and on–station, identify and address problems perceived by the farmers in a holistic and interdisciplinary manner;

(2) developing low–input, sustainable technologies;

(3) empowering farmers to make their own decisions; and

(4) maximizing resources available in the region by linking academic institutions and government agencies.

## Somalia

### Project Overview

Agricultural Farm Management Extension Training (AFMET) is funded by USAID, World Bank, and African Development Fund. The project attempted to further technology transfer to limited resource farmers through participatory extension and adaptive research.

### Constraints

Initially there was minimal participation by the Central Agricultural Research Station.

### Impacts

Extension staff and farm families were trained. Both groups participated in conducting verification trials and recommended demonstrations for Field Days.

Field Extension Agents (FEAs), District Extension Officers (DEOs) and Specialists all participated in data collection.

AFMET analyzed the data, which was then fed back to farm families.

The USAID-funded Bay Region Research Project (649-0113) worked closely with the Extension staff in both plot-work and training.

The two projects collaborated to establish an FSR/E programming prototype.

The sorghum breeding program shifted as a result of analysis of farmers' preference in plant structure; they preferred a tight-headed type that better resisted insects in storage, compared to the looser-headed, higher yielding recommended variety.

## Swaziland

### Project Overview

The Swaziland Cropping Research and Extension Training Project (SCSRETP), funded by USAID, began in 1981 and continues to the present. Its three original objectives were directed toward Swaziland National Lands (SNL) farmers.

It planned to carry out on-farm research with the cropping/farming systems perspective. It intended to train both extension and research workers to increase their ability to develop appropriate research recommendations and transmit them, in an understandable and useful form, to front-line extension workers and farmers.

Its final objective was to better equip the faculties of the Agricultural Information Section to translate and to transmit research findings more effectively, and to improve technologies through the extension system to SNL farmers. A baseline study was carried out which indicated a preference for off-farm rather than on-farm research income. The study also indicated that the labor saved in agriculture was used to produce off-farm wage income. On-farm cropping trials began in 1982-83 and by 1986-87 had expanded to 116 locations in ten rural development areas.

### Constraints

The research division of the Ministry of Agriculture and Cooperatives suffered large staff losses at all levels resulting in a reduction of research activity. Extension budgets were cut back. Demonstration plots were terminated at the time the on-farm were beginning, thus making it easy for both Extension personnel and farmers to confuse the two. the on-farm trials were poorly designed and poorly conducted. On-farm research showed a great deal of variation in results. Many of the trials had unusable data. The research assistants were poorly trained and did not understand the purpose of their field work. Farmers adopted components of the on-farm trials prior to the completion of testing. The research assistants were asked to conduct activities for which they had little training, experience or incentive. The desire to reduce labor inputs led to a focus on mechanical innovations aimed at higher income farmers. The Swazi policy of reaching maize self-sufficiency, of which this project is a part, has been confined to the production systems. The post-production systems and economic policy environment were not addressed, making adoption of technology more difficult.

### Impacts

Radio and newspapers were used in 1987 to inform the farmers and others involved in agricultural development of the differences between and purposes of research and extension. Coordination gradually increased between on-station and on-farm research to ensure that trials attempted on-farm had been proven potentially feasible on the Experiment Station. Methods to better coordinate the availability of inputs with the proposed on-farm trials were designed.

## Thailand

### Project Overview

The Rainfed Cropping Systems Project began in 1975 with Ford Foundation funding. The Integrated Rainfed Farming Systems Research Project began in 1984 with USAID funding, which added an animal science component. This broadened the project from cropping systems to include a farming systems research approach. The initial project's objectives were: 1) to develop cropping systems for rainfed cultivated areas of northeast Thailand; 2) to identify crop varieties and improve cultural practices suitable for the cropping systems under rainfed conditions; and 3) to provide a research framework in which staff members and students could participate in the problem-solving efforts at the farmers' level. The first approach was to increase crop intensification and crop diversification by using the full growing season. In 1985, the project was expanded to a farming systems project, in conjunction with integrated crop and livestock enterprises of small farmers.

A number of agronomically possible, but socially impossible, cropping patterns were tested on farmers' fields. In 1981, the project began to look at farmers' traditional agricultural practices, identifying agronomically and socially workable cropping patterns.

### Constraints

The urban background of the scientists was a problem. Scientists were reluctant to learn from the farmers. There was an initial lack of coordination between the University and Extension. A drought occurred during the first year of farming systems research.

### Impacts

Farmers in several villages adopted the new practice of planting peanuts after rice. This method was identified by assuming social as well as biological constraints.

Farmers used careful land preparation and soils with a high water table.

Several other promising cropping systems were identified through on-farm trials.

Due to the importance of social factors in farmers' rejection of new technologies, social scientists other than agricultural economists, are now included on the research teams.

The staff is trained in concepts of human ecology and in agro-ecosystem analysis.

Interdisciplinary interaction increased.

Formal linkages were established between FSR practitioners and component researchers.

Strong linkages were established with action agencies, including the Department of Agriculture, the Field Crops Research Institute, the Department of Agricultural Extension, the Northeast Regional Office for Agriculture and Cooperatives, and other ongoing projects.

FSR training was integrated into that of other agencies.

Closer links were formed with Agricultural Extension through a joint program on multilocational testing of planting groundnuts after rice without irrigation.

An annual Farming Systems Workshop is coordinated as a result of the project.

An FSR newsletter is published and distributed.

There is close collaboration with IRRI, ICRISAT, the East–West Center, and SUAN.

A farming systems orientation replaced the cropping systems approach in 1985. Livestock scientists and relevant government departments were integrated into the research agenda.

## Tanzania

### Project Overview

The Tanzanian Farming Systems Project (TFSP) was implemented from August 1983 to September 1986. Its goal was to improve the Tanzanian Agricultural Research Organization's (TARO) capacity in research and extension using the FSR approach. TFSP was funded by USAID who provided external funding, and contracted the Consortium for International Development (CID) to provide technical assistance, with Oregon State University as the lead university. Additional funding was provided by the Government of Tanzania.

### Constraints

TFSP lacked personnel trained in FSR. Social scientists were outnumbered by biological scientists. Counterparts to the technical assistance team were not assigned. There were delays in the recruitment of project staff. Some project personnel, particularly the field staff, lacked experience in implementing on-farm experiments. The personnel problem was aggravated by lack of project leadership. TARO's inefficiency in carrying out its role as lead agency affected its capacity to institutionalize the FSR/E approach.

TFSP was pressed for time to produce significant impacts within a short time. Tanzanian researchers were not involved in the development of the project design and so were reluctant to cooperate. Research on other systems that affect the farmer was inadequate. There was little understanding of intrahousehold dynamics, women's participation in decision-making and the specific tasks they perform with their husbands and individually.

Reduced technical assistance and funding negatively affected the project activities. The role of extension service was not clearly defined. TARO's commodity researchers were reluctant to transfer to the FSR section as full-time staff. They felt that their skills were better used in their current positions and were skeptical about the FSR's future.

### Impacts

TFSP introduced a new method in conducting agricultural research. It changed TARO's commodity researchers' view on the FSR approach. There was an increase in FSR knowledge coupled with an increase in appreciation of the FSR approach among 92 percent of the respondents.

Successful on-farm experiments and on-station research helped establish the FSR section within TARO.

Staff had the opportunity to attend nondegree and degree training held locally and abroad.

It improved the availability and use of research information for locally grown food crops.

FSR influenced on-station researchers to focus research priorities on farmers' existing condition.

Farmers' participation in varietal evaluation and assessment of labor requirements influenced on–station researchers. Farmers' feedback on the introduction of kito and staha maize varieties encouraged commodity researchers to integrate farmers' evaluation on proposed new technologies.

On–station research shifted to intercropping due to observations made on farmers' fields.

TFSP established a linkage between on–farm and station researchers.

Project research showed that higher yields result from mixtures than from pure lines, as both rust and angular leaf spot increased less rapidly in mixtures.

## Zaire

### Project Overview

The Kwango–Kwilu Project, the Zaire Agricultural Productivity Project and the follow–up, 1978 to present is funded by UNDP/FAO. The first project, which began in 1978, consisted of a large–scale survey of producers in the region to identify the principal agricultural production constraints. The follow–up project in 1981 built on the findings by testing ways of improving traditional methods of cassava production. The survey found that most food production is in the hands of women, with nearly exclusive reliance on female labor. The goal was to conduct research to improve cassava production and farm household welfare.

### Constraints

There has been a consistent decline in soil fertility. The government policy of cultures imposees, which requires a specific number of hectares for each major crop, has resulted in an inefficient allocation of labor and land resources. There has been an increased incidence of diseases and pests. Agricultural prices are unfavorable. Purchased inputs are not available, and if they were, would not be affordable. There is a lack of knowledge of alternative cropping systems for sandy soils. The ineffective extension service was made even more ineffective because extension agents were male and primarily were involved with ensuring the application of the cultures imposees and with recording statistics. There was a low degree of farmer organization.

### Impacts

The practices of successful women farmers were evaluated and extended to other farmers.

The criteria used by women to select local varieties of cassava were identified and added to the researchers' criteria of cassava evaluation.

Guided by preferred product characteristics, two areas of experimentation were undertaken: developing and introducing new technology, and testing new forms of organization for the diffusion of knowledge and technology.

New technologies were introduced including: the most successful local techniques for growing cassava, the best local varieties as well as those varieties developed by the programme national manioke, new hoes for soil preparation, simple maize shellers, and firewood species in combination with anti–erosion measures.

A network of animatrices were introduced who work with existing NGOs to reach other women farmers.

Extension agents were trained in the FSR/E methodology.

Linkages with existing institutions were established to disseminate projects results.

## Zambia

### Program Overview

The Adaptive Research Planning Team (ARPT) has conducted On-Farm Client-Oriented Research (OFCOR) in Zambia since 1980. The Research Branch (of which the ARPT is a part) of the Department of Agriculture in the Ministry of Agriculture and Water Development (MAWD) is responsible for most agricultural research in Zambia. ARPT is of equal status to and complements the national commodity programs. The research system is quite centralized despite an extensive network throughout the country.

In 1986 the ARPT had several provincial teams backstopped by a national coordinator, four regional sociologists, and one nutritionist. Each team is funded by a different donor and is intended to include a Farming Systems Economist, Farming Systems Agronomist and a Research Extension Liaison Officer (RELO). Until now, little attention has been given to the problems of livestock.

### Constraints

A complex and high-risk environment, especially the semiarid plains and deserts -- has impeded agricultural development. Most farmers in the northern high-rainfall region are small-scale and subsistence-oriented, practicing both shifting cultivation and semipermanent cultivation. Population pressure has led to the rest-fallows becoming shorter and inadequate. Tsetse flies are endemic in large parts of the zone, and limit the keeping of cattle.

The Research Branch has had to rely increasingly on funds from external sources. This has influenced research priorities.

In more remote areas, communication is difficult, especially in the valley areas and on the Kalahari sands of Western and Northwestern Provinces. Roads normally deteriorate during the rainy season. Long distances and the poorly maintained vehicle fleet have resulted in high transportation costs.

The major constraints for the subsistence and small-scale commercial farmers are technological. They include labor bottlenecks, low soil productivity, and lack of varieties for farmers' specific situations.

### Impacts

There is policy emphasis on small-scale farmers.

The project has support from senior research managers.

Farm-level information has been disseminated.

It has enhanced the application of an interdisciplinary systems perspective within research. Interaction has been stimulated by formal management mechanisms such as regular team meetings, co-involvement in the preparation of Trial Outlines, and circulation of correspondence and reports among all team members.

ARPT has characterized the major farming systems and client groups, using agro-ecological and socioeconomic criteria. They have begun to diagnose priority production problems and identify key opportunities for research.

ARPT is conducting experiments under farmers' conditions in order to adapt existing technologies and contribute to the development of alternative technologies for targeted groups of farmers sharing common production problems.

Increased interaction between ARPT and CSRT scientists has augmented the availability of proposed technologies.

ARPT promotes farmer participation in research as collaborators, experimenters, testers, evaluators, and disseminators of alternative technologies.

ARPT provides feedback to the research priority–setting, planning and programming process This research helps integrate experiment station and on–farm research into a coherent program focused on farmers' needs.

ARPT promotes collaboration with extension and development agencies to improve the efficiency of technology generation and diffusion processes.

ARPT influenced commodity programs to screen maize and sunflower varieties with and without fertilizer in CSRT national variety trials.

A research–extension liaison officer was established.

Provincial and district extension workers are included in provincial ARPT steering committees. This assures extension input, and has made members committed to influence policy vis–a–vis market, credit, and input institutions.

The skills and legitimacy of extension workers have been increased by utilizing them to oversee on–farm trials in each extension domain.

Extension personnel at district, provincial, and national levels have been trained in FSR/E.

A monthly newsletter is circulated.

Extension ideas are incorporated into FSR/E testing and evaluation.

Relations were established with two major integrated rural development projects, including pooling funds for specific purposes and jointly monitoring yields from farmer–managed trials.

There have been steps taken toward eliminating technological constraints for small–scale farmers.

CSRT scientists in the Maize Research Team have been active in parental line purification development and release of earlier hybrids and open–pollinated varieties.

The Wheat Team has developed improved varieties, such as Emu–S, Loerie, and Canary.

The Sunflower Team noted increased resistance to Alternaria as an especially important varietal improvement.

The Soybean Team has released three new varieties and has identified two freely nodulating lines.

The Plant Protection Section formulated recommendations for pest and weed control.

Other research teams noted considerable progress with varietal improvement in vegetables, groundnuts, and cotton.

## Zimbabwe

### Project Overview

The Farming Systems Research Unit of the Agronomy of the Institute of the Crop Research Service, was initiated in 1980 to improve crop productivity in the communal areas of the country. Funding has been provided by IDRC (International Develpoment Research Council), ILCA (International Livestock Center for Africa), and CIMMYT (International Maize and Wheat Improvement Center). CIMMYT provided technical guidance and support, staff training, and complementary financial assistance to the program. On-farm research trials were initiated in the 1981-82 cropping seasons based on a diagnosis aided by other institutes in the Department of Research and Special Services (DR and SS), the Department of Agricultural and Technical Services (AGRITEX), CIMMYT, and the Department of Land Management at the University of Zimbabwe. During the first two years, the research program focused on strategies to improve maize production efficiency, to improve varieties, to improve management, and to reduce tillage alternatives. Because of the drought, research shifted toward investigating drought-tolerant crops and crop alternatives, in addition to continuing the maize research program. In 1982 the livestock and pasture research division began work with ILCA on a farming systems project for livestock production in the communal areas. In 1984, a single farming unit was formed from these two efforts. The FSR is an autonomous unit, with a core team in Harare guiding and supporting the two small teams of crop and livestock researchers.

### Constraints

There is a shortage of marketing facilities in Zimbabwe. Farming systems research has little input into the price-setting boards. Most recommendations for agricultural production were made on the basis of large farms with mechanical draft power. There has been declining availability of food in communal areas. Periodic droughts, including one during the early part of the project beset the area. Shortage of cash is a constant problem for the farm families, as is a shortage of labor, since many male family members must temporarily migrate to find off-farm labor. The land in the communal areas is of low quality. There is insufficient draft power and low soil fertility. Labor and cash-flow problems, as well as pests and diseases, are important cropping season constraints. There is difficulty in controlling the grazing areas, because many of those who own livestock do not manage them, thus encouraging the "tragedy of the commons." There has been a chronic shortage of technical information and dissemination. Technology transfer is difficult because the majority of extension workers are men, whereas many of the household heads and implementers are women.

### Impacts

The University of Zimbabwe, in cooperation with CIMMYT, has one of the few farming systems training and degree programs in the world. Practicums for that training are held often in Zimbabwe.

Food production has increased in the communal areas in Zimbabwe.

A model of farming systems research was developed and tested. Found to be acceptable to DR and SS, it was instituted in other areas of Zimbabwe.

The research units provided information for the formulation of agricultural development policy for the communal areas.

Close interaction between the FSR staff, station scientists and various DR and SS program participants has resulted in a better understanding of the FSR philosophy and strategies and in a mutually beneficial working relationship.

The AGRITEX staff and organized communal groups participate actively in the research program.

AGRITEX staff and farmers receive FSR/E in-service training on a regular basis.

The FSR unit has squarely addressed agricultural production problems in the communal areas, particularly by addressing yields per unit area.

Farmers views on technologies under test are routinely used in trial evaluation.

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