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NEPAL

ORGANIZATION AND MANAGEMENT OF ON-FARM RESEARCH IN THE NATIONAL AGRICULTURAL RESEARCH SYSTEM

by

Badri Nath Kayastha

Sudarshan Bhakta Mathema

and

Peter Rood

WAITE MEMORIAL BOOK COLLECTION
DEPT. OF AG. AND APPLIED ECONOMICS
1994 BUFORD AVE. - 232 COB
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International Service for National Agricultural Research

The International Service for National Agricultural Research (ISNAR) began operating at its headquarters in The Hague, Netherlands, on September 1, 1980. It was established by the Consultative Group on International Agricultural Research (CGIAR), on the basis of recommendations from an international task force, for the purpose of assisting governments of developing countries to strengthen their agricultural research. It is a non-profit autonomous agency, international in character, and non-political in management, staffing, and operations.

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Special Series on the Organization and Management of
On-Farm Client-Oriented Research (OFCOR)

OFCOR–Case Study No.4

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INTRODUCTION TO THE ISNAR STUDY ON ORGANIZATION AND MANAGEMENT OF ON-FARM CLIENT-ORIENTED RESEARCH

Deborah Merrill-Sands
Study Leader

Introduction

In 1986, ISNAR initiated a major study on the organization and management of on-farm, client-oriented research (OFCOR) in national agricultural research systems. The study was developed in response to requests from leaders of national research systems for advice in this area and was carried out with the support of the Government of Italy and the Rockefeller Foundation. The objective is to analyze the critical research policy, organizational and managerial factors which affect national agricultural research institutes' capacities to integrate and sustain on-farm, client-oriented, research as a stable and productive component of the research process.

What is on-farm, client-oriented, research?

On-farm, client-oriented, research (OFCOR)[1] is designed to help research systems meet the needs of specific clients, most commonly resource-poor farmers. It complements -- and is dependent upon -- experiment station research. It involves a farmer-oriented philosophy, a specific research approach and methods, and a series of operational activities carried out at the farm level. These activities range from diagnosis and ranking of problems through the design, development, adaptation, and evaluation of appropriate technological solutions. Farmers are directly involved at various stages in the process.

In this study, on-farm, client-oriented, research programs are analyzed in terms of the functions this type of research can perform within the larger research and extension process. We have identified the following seven potential functions as a framework for analyzing the organization and management of a range of on-farm research programs in nine national agricultural research systems. The functions are:

1) to support within research a problem-solving approach, which is fundamentally oriented toward farmers as the primary clients of research;

2) to contribute to the application of an interdisciplinary systems perspective within research;

3) to characterize major farming systems and client groups, using agroecological and socioeconomic criteria, in order to diagnose priority production problems as well as identify key

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1/ We have used the generic term "on-farm, client-oriented, research" (OFCOR) as distinct from "farming systems research" (FSR) because the latter has come to have too many different and confusing meanings.

opportunities for research with the objective of improving the productivity and/or stability of those systems;

4) to adapt existing technologies and/or contribute to the development of alternative technologies for targeted groups of farmers sharing common production problems by conducting experiments under farmers' conditions;

5) to promote farmer participation in research as collaborators, experimenters, testers, and evaluators of alternative technologies;

6) to provide feedback to the research priority-setting, planning and programming process so that experiment station and on-farm research are integrated into a coherent program focused on farmers' needs;

7) to promote collaboration with extension and development agencies in order to improve efficiency of the technology generation and diffusion processes.

Why is organization and management of on-farm, client-oriented, research important?

Over the last 15 years, many national agricultural research systems have set up on-farm research programs of varying scope and intensity to strengthen the link between research and farmers -- particularly resource-poor farmers. While significant attention has been given to developing on-farm research methods, provisions for fully integrating this approach within the research process have been inadequate and the institutional challenge often underestimated. With the accumulation of experience, it is clear that national research systems have confronted significant problems in implementing and effectively integrating on-farm, client-oriented, research into their organizations. In many cases, these programs have become marginalized and have not had the intended impact on the research process.

Improved organization and management are crucial to overcoming these problems. Effectively integrating on-farm research programs with a strong client orientation within a research system implies forging a new research approach which complements and builds on existing research efforts. This is no small task. It involves establishing new communication links between researchers of diverse disciplines, extension agents, and farmers. It requires hiring people with the right skills or systematically training existing staff. It requires changes in planning, programming, review, and supervisory procedures. It creates increased demands for operational funds and logistical support for researchers working away from headquarters. And, it often involves working with one or more donor agencies. All of these make the management of OFCOR more demanding than that of traditional experiment station research.

This study focuses directly on these issues of implementation and institutionalization. We have analyzed and synthesized the experiences of diverse national research systems in which on-farm, client-oriented, research programs have been established for at least five years. The intention is to provide a body of practical

experience upon which research managers can draw as they strive to strengthen on-farm research as an integral part of their research systems.

Operational strategy and products of the study

Our approach has been to learn from the experiences of research managers in national agricultural research systems. We have built the analysis around case studies of nine countries whose national research systems have had sufficient time to experiment with and develop diverse organizational arrangements and management systems for implementing on-farm, client oriented, research. By region, the countries are as follows:

Latin America: Ecuador, Guatemala, Panama.

Africa: Senegal, Zambia, Zimbabwe.

Asia: Bangladesh, Indonesia, Nepal.

The case studies are stand-alone products. Each is a comprehensive analysis developed by a team of national researchers with personal experience in the individual on-farm research programs. The cases provide important insights and lessons on the general issues, as well as specific guidance for research policy and the organization and management of on-farm research in their countries. The cases will be published in 1988 and 1989. A list of the reports follows.

Comparative study papers providing a systematic analysis across the case studies are a second product of the study. Synthesizing the experience of case study research institutions, these papers provide practical advice to research managers on organizational and managerial issues central to integrating on-farm research focused on resource-poor farmers within their research systems. The themes developed are:

* Alternative arrangements for organizing on-farm, client-oriented research: comparative strengths and weaknesses
* Integrating on-farm and experiment station research: organizational and managerial considerations
* Organization and management of resource-poor farmer collaboration in research
* Organization and management of linkages between on-farm research and extension
* Organization and management of field activities
* Development and management of human resources for on-farm, client-oriented, research
* Financial resource use and management in on-farm research
* Management of relations with donors and external sources of knowledge
* Issues in the institutional development of on-farm, client-oriented, research in national agricultural research systems.

We expect these papers to be published during 1988 and 1989. They are working papers presenting results of the analysis of the nine concrete case study situations. At this stage, they are intended to stimulate discussion and debate; they are not presented as "state-of-the-art" pieces on these topics.

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OVERVIEW OF THE NINE CASE STUDIES

Deborah Merrill-Sands
Study Leader

The on-farm, client-oriented, research efforts reviewed in the cases vary in scope, the emphasis assigned to different objectives and functions, and the specific methodologies employed. They all conform, however, to the general definition of on-farm, client-oriented, research developed for this study. The cases reflect a variety of institutional settings and strategies for introducing and developing on-farm research. They also reflect the broad range of models used in the organization and management of on-farm research. The profiles below highlight the salient features of each case and Table I provides some key descriptive indicators for comparison across cases.

Latin America

Ecuador:

On-farm, client-oriented, research is conducted by the Production Research Program (PIP, Programa de Investigación en Producción), an autonomous program within the Instituto Nacional de Investigaciones Agropecuarias (INIAP). It has two national coordinators responsible for the highland and coastal macro-regions and 10 regional field teams assigned to different provinces under the administrative auspices of regional experiment stations. Five teams are associated with integrated rural development programs.

Initiated in 1977 with support from CIMMYT, the case allows us to trace the evolution of the organization and management of an on-farm research program from its origins as a pilot project through to its institutionalization as a full-fledged national program.

Guatemala:

A client-oriented research philosophy pervades Guatemala's 16-year-old agricultural research institute, the Instituto de Ciencias y Technología Agrícolas (ICTA). Two units, however, are specifically charged with carrying out the functions of on-farm, client-oriented, research: the Technology Testing Department and the Socioeconomics Department. The first is responsible for testing in on-farm trials all technology developed by the commodity programs. The second conducts diagnosis, on-farm monitoring, and special studies.

The 14 Technology Testing Teams are made up of scientists and technicians whose research is coordinated from regional stations, but who live and work in designated research areas. The Socioeconomics Department is organized at the national level with

representatives in some of the regions. Almost all scientists in the department are agronomists with training in social science methods. Coordination between the two departments is limited.

ICTA's experiences with on-farm research have had a major informative influence on other countries. What makes the Guatemala case especially is that on-farm, client-oriented, research was not appended onto an existing system. Rather, ICTA was set up from the beginning to incorporate such an approach. Moreover, the ICTA case also allows us to examine the organization and management of on-farm research within a regionally organized research system. This is important because a regionalized research system has generally been regarded as the institutional setting most compatible with the organizational requirements of on-farm, client-oriented, research.

Panama:

In the late 1970s, the Instituto de Investigación Agropecuaria de Panamá (IDIAP) developed a "national plan" through which priority areas for on-farm research were selected. On-farm research is implemented in some of these areas as part of the regular research programs of scientists who also work on-station. In other areas, it is implemented through projects with full-time staff, developed in collaboration with international agricultural research centers. The projects are variable in organization and operations, and there is no mechanism at the national level for coordinating the diverse on-farm research efforts. What is particularly interesting about Panama's experience is the institutionalization of on-farm, client-oriented, research as a research strategy, rather than as a formal program with a discrete on-farm research unit or units.

Africa

Senegal:

The Department of Rural Sociology of the Institut Sénégalais de Recherches Agricoles (ISRA) initiated an on-farm, client-oriented, research program in 1978. It is now part of the Department of Production Systems and Technology Transfer (DRSP, Département des Recherches sur les Systèmes de Production et le Transfert de Technologies en Milieu Rural), one of the four main research departments established in 1982 after a major reorganization of ISRA under the auspices of a World Bank project. The DRSP consists of a Central Systems Analysis Group (GCAS, Groupe Central d'Analyse Systèmes), three multidisciplinary research teams located at regional stations, a Bureau of Macro-economic Analysis (BAME, Bureau d'Analyses Macro-Economiques), and a division of thematic research. The case focuses on the on-farm, client-oriented, research part of the DRSP, namely the GCAS and the three regional teams.

Senegal is an interesting case because the classic regional team model for implementing on-farm, client-oriented, research was modified to include a core multidisciplinary group of scientists, the GCAS, which supports the work of the teams. Also of interest is Senegal's experience blending francophone and anglophone approaches to on-farm research.

Zambia:

The Adaptive Research Planning Team (ARPT) conducts on-farm, client-oriented, research in Zambia. The ARPT, initiated in 1980, is a national research program under the Research Branch of the Ministry of Agriculture. It is of equal status to and complements the national commodity programs. The ARPT comprises a national coordinator, based at the central research station, and seven teams of scientists and field technicians at provincial experiment stations. Each team is funded by a different donor.

ARPT includes two important innovations: the formal integration of sociologists and the inclusion of research-extension liaison officers in the teams.

Zimbabwe:

Zimbabwe's Department of Research and Special Services (DR & SS) adopted on-farm, client-oriented, research in 1980 as a strategy for reorienting research to meet the needs of small farmers in the communal areas. This was in response to the post-independence national policy to emphasize agricultural development for this sector.

There is no integrated on-farm research program. Several research institutes and stations and a specialized Farming Systems Research Unit (FSRU) have developed independent initiatives. The case study examines on-farm, client-oriented, research in the Farming Systems Research Unit and four institutes -- the Cotton Research Institute, the Agronomy Institute, the Crop Breeding Institute, and a regional research station. This provides us with an unusual opportunity to analyze the implementation and integration of on-farm research under several distinct models for organizing research, but all within a single institution.

In the institutes, individual scientists carry out both on-farm and station-based research, while scientists in the FSRU specialize in on-farm research. The FSRU consists of a core multidisciplinary team based at the central station and two regional teams staffed by technicians. Their research has had a strong systems perspective emphasizing crop-livestock interactions.

Asia

Bangladesh:

The Bangladesh case study concentrates on the on-farm research activities of the Bangladesh Agricultural Research Institute (BARI), the largest unit of the NARS. The On-Farm Research Division (OFRD), created in 1985, has the exclusive mandate for on-farm research in BARI. On-farm research teams are located at 23 stations and substations, from which they direct technicians in 11 farming system research sites and 83 multi-locational testing sites.

The OFRD subsumed four distinct older programs: multi-locational testing of the Soil Fertility and Soil Testing Institute (later

renamed the On-Farm Trials Division); cropping system research on the IRRI model; varietal testing and verification of the wheat program; and the adaptive research of the T & V Extension Research Program. An important aspect of the Bangladesh case study is its analysis of the consolidation of these different approaches to OFCOR under common management.

Indonesia:

On-farm, client-oriented, research is implemented in Indonesia's Agency for Agricultural Research and Development (AARD) in sub-programs of the commodity institutes, and also in multi-institute projects organized at the AARD level. The case study focuses on two examples of each major type.

The multi-institute projects are an interesting institutional innovation. These projects are staffed by senior scientists seconded from the participating institutes. They maintain contact with their home institutes and return to them at the end of the project. We wanted to examine this arrangement because of its potential for building strong links between on-farm research and station-based specialist scientists, as well as for the long-term integration of the on-farm, client-oriented, research philosophy and methodology within the national research system.

The gradual evolution of on-farm, client-oriented, research in the national research system is another important aspect of the Indonesian experience. Starting as an informal program of one institute in the early 1970s, on-farm and systems research methods were slowly integrated into other commodity institutes. Specialized teams have only been developed since the early 1980s. On-farm, client-oriented, research in Indonesia has been a national initiative which has drawn on a number of approaches, particularly that of the Asian Cropping Systems Network developed in association with International Rice Research Institute.

Nepal:

On-farm research programs of different types have existed in a variety of institutions in Nepal since the early 1970s. Out of the diverse settings of on-farm research in Nepal, we chose five subcase studies which illustrate the major models of organizing on-farm client-oriented, research:

-- OFCOR implemented through a commodity program -- the National Rice Improvement Program;
-- OFCOR implemented through a cropping systems program;
-- OFCOR implemented through a specialized unit -- the Farming Systems Research and Development Division (FSR & DD), supported by a separate socioeconomics division;
-- OFCOR implemented as a generalized strategy in two small, externally funded, regional research institutes -- Lumle Agricultural Research Centre and Pakhribas Agricultural Centre.

The contrast between the on-farm, client-oriented, research programs of the national research system and those of the externally funded institutes make Nepal an especially interesting case.

Table I
Descriptive indicators of the nine OFCOR case studies

Case Studies	National Agricultural Research System		Organization of OFCOR	Years in Operation [3]	Scale of OFCOR: (Scientist Years per Year)	
	Institutional Type	Organization of Research Program			OFCOR as % of NARS Human Resources	Size of OFCOR effort
Ecuador	Semiautonomous institute (INIAP)	Regional research stations/commodity programs	Production Research Program (PIP)[b]: National program with two coordinators and 10 teams based at regional research stations.	9	6	14
Guatemala	Semiautonomous institute (ICTA)	Regional research programs/commodity programs	Technology Testing Department with 14 field teams in 6 regions and national socioeconomics department with limited regional representation	14	34	65
Panama	Semiautonomous institute (IDIAP)	Commodity programs/ regional offices	National OFCOR plan identified target regions where OFCOR is implemented through special FSR projects or part-time on-farm research	7	16	24
Senegal	Semiautonomous institute (ISRA)	Multi-commodity departments/ regional stations	OFCOR, located within Department of Production Systems Research and Technology Transfer (DRSP)[d], consists of 3 regional teams and a Central Systems Analysis Group	4	13	22
Zambia	Ministry (MAWD)	Commodity and factor programs	OFCOR program with national coordinator and 7 provincial teams at regional stations	6	20	38[h]
Zimbabwe	Ministry (MLARR)	Commodity and disciplinary based institutes and stations	OFCOR implemented by: - 8 research institutes/stations with combined on-station/on-farm research programs; - Farming Systems Research Unit (FSRU) based at central station with two regional teams.	6	18	26
Bangladesh[1]	BARI, semiautonomous institute of larger NARS with council	Disciplinary departments/ commodity programs	On-Farm Research Division (OFRD), with Central Management Unit at headquarters and 24 teams deployed through BARI's network of regional stations, has official mandate for on-farm research. Consolidation of previous OFCOR efforts	9[e]	12	104
Indonesia[2]	Ministry, Dept. of Research (AARD) with multiple institutes and coordinating bodies	Commodity-based regional institutes	Two principal modes of implementation: - Research institutes conduct OFCOR as part of regular programs; - OFCOR projects organized at AARD level with staff seconded from multiple institutes.	11[f]	n/a	57[i]
Nepal[2]	I. NARS: ministry II. LAC and PAC:[a] externally funded autonomous institutes	I. Commodity programs / disciplinary departments II. LAC: Multi-disciplinary research thrusts PAC: Disciplinary departments	I. - Farming Systems Research and Development Division (FSR&DD) with 6 FSR sites, supported by Socio- Economics Research and Extension Division (SERED); - Commodity programs with multi-locational testing and outreach programs. II. LAC and PAC, regional institutes with OFCOR as a generalized research strategy	14[g]	n/a	35[i]

NOTES FOR TABLE I

1. The case study is limited to the Bangladesh Agricultural Research Institute (BARI), the largest of the 5 institutes coordinated by the Bangladesh Agricultural Research Council (BARC).

2. Data refers only to the sub-case studies unless otherwise indicated; NARS-wide data not available.

3. Base year for all statistical data is 1986.

a. Lumle Agricultural Center and Pakhribas Agricultural Center.

b. Programa de Investigación en Producción.

c. The Spanish names for these departments are Prueba de Technología and Socioeconomía.

d. Département de Recherche de Systèmes de Production et Transfert de Technologies en Milieu Rural.

e. Refers to NARS. Several OFR programs with complex histories operate within BARI. The oldest, the On-Farm Fertilizer Program dates back to 1957. This program was reorganized in the late 1970's, about the same time Cropping Systems Research was established in BARI. The OFRD was not formally consolidated until 1984.

f. Refers to NARS. In 1973, multiple cropping research in the Central Research Institute for Food Crops took on a systems orientation and was renamed cropping systems research (CSR). CSR moved onto farmers' fields in 1975.

g. Refers to NARS. Cropping/farming systems research was initiated 9 years ago. On-farm rice research is 14 years old.

h. Includes 6 Research-Extension Liaison Officers seconded from extension.

i. Represents totals for sub-case studies only. Not directly comparable to other NARS-wide data.

LIST OF CASE STUDY REPORTS

-- Zambia: Organization and Management of the Adaptive Research Planning Team (ARPT), Research Branch, Ministry of Agriculture and Water Development. (S.A. Kean and L.P. Singogo) OFCOR Case Study No. 1. Now available.

-- Zimbabwe: A Case Study of the Organization and Management of Five On-Farm Research Programs in the Department of Research and Special Services, Ministry of Agriculture. (M. Avila, E.E. Whingwiri, and B.C. Mombeshora)

-- Sénégal: Organization et Gestion de la Recherche sur les Systèmes de Production, Institut Sénégalais de Recherches Agricules (ISRA). (J. Faye and J. Bingen)

-- Ecuador: Un Estudio de Caso de la Organización y el Manejo del Programa de Investigación en Finca de Productores en el Instituto National de Investigaciónes Agropecuarias (INIAP). (R. Soliz, P. Espinosa, and V.H. Cardoso)

-- Guatemala: Organización y Manejo de la Investigación en Finca en el Instituto de Ciencia y Technología Agrícolas (ICTA). (S. Ruano and A. Fumagalli) OFCOR Case Study No. 2. Now available.

-- Panamá: Un Estudio de Caso de la Organización y el Manejo del Programa de Investigación en Finca de Productores en el Instituto de Investigación Agropecuaria de Panamá (IDIAP). (M. Cuellar)

-- Bangladesh: A Case Study of the Evolution and Significance of On-Farm and Farming Systems Research in the Bangladesh Agricultural Research Institute (BARI). (M.A. Jabbar and Md. Zainul Abedin) OFCOR Case Study No. 3. Now available.

-- Indonesia: A Case Study of the Organization and Management of On-Farm Research in the Agency for Agricultural Research and Development, Ministry of Agriculture. (J. Budianto, I.G. Ismail, Siridodo, P. Sitorus, D.D. Tarigans, A. Mulyadi, Suprat)

-- Nepal: A Case Study of the Organization and Management of On-Farm Research in Nepal. (B.N. Kayastha, S.B. Mathema, and P. Rood).

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FOREWORD

For 30 years Nepal has been a pioneer in developing research methods and innovative ways of conducting on-farm client-oriented research. Numerous organizations in Nepal are active in on-farm research as they strive to produce relevant technologies for the country's diverse farming systems and agro-ecological conditions. These include the public-sector national agricultural research system, two British-funded regional research centers in the Hill region, and numerous agricultural and rural development projects.

With its long history and broad involvement in research in farmers' fields, Nepal offers a wealth of innovative experiences in organizing and managing on-farm research. This case study analyzes five research programs representing distinct models for organizing on-farm client-oriented research. The first three, a commodity program, a cropping systems program, and a farming systems research division are all part of the Ministry of Agriculture's research efforts.

The remaining two programs are small regional research centers in the Hills, wholly funded by the British government; but they are closely linked to the government research system. With their focused regional mandates and independent funding, these two centers have been able to experiment actively with different methods and ways of organizing and managing on-farm research.

The five on-farm research programs analyzed in the case are described briefly below.

1) The National Rice Improvement Program, based at the Parwanipur Agricultural Station, has used on-farm research for over 15 years to identify suitable varieties for different agro-ecological regions in the country. Its approach, typical of that used by all commodity programs, follows two streams. The first is the wide on-farm testing of promising rice varieties. This is done through a national program of standardized farmer field trials managed by researchers and through a "minikit" program in which small packets of seed, sometimes accompanied by measured amounts of fertilizer or pesticide, are distributed to farmers through extension. The second stream is the research outreach program, designed to identify and solve farmers' production constraints through applied and adaptive research. The program targets the districts surrounding the experiment station and works closely with a Training and Visit extension project funded by the World Bank.

2) The Cropping Systems Program, active from 1977 to 1985, was part of the USAID-funded Integrated Cereals Program. Located within the Department of Agriculture's Agronomy Division, the program was designed to complement experiment station research by expanding adaptive research at the farm level. Conducting on-farm trials and surveys at six sites, the program was the first to bring natural scientists and social scientists together into an interdisciplinary team. During its eight years, the program had some major successes in developing technologies and

new cropping patterns for the more favorable Tarai region, but it was less successful in addressing the problems of the more complex farming systems of the Hill region. Other on-farm research programs in Nepal have drawn extensively on the experiences of the Cropping Systems Program in on-farm research methods and the actual management of field operations.

3) The Farming Systems Research and Development Division was established after the termination of the Integrated Cereals Program in 1985 as a way of building on the work of the Cropping Systems Program and institutionalizing on-farm client-oriented research within the national research system. Some important changes were made: the mandate was broadened to also encompass livestock and agroforestry components, research sites were concentrated in the Hill region, and socioeconomics was separated off into a sister division -- the Socioeconomic Research and Extension Division. The Farming Systems Research and Development Division has a national mandate and is now the leading government program responsible for conducting on-farm client-oriented research.

4) The Lumle Agricultural Centre was originally set up in 1968 as a training and extension center for Gurkha soldiers returning from the British army. Since 1974, however, at the request of the Government of Nepal, the center has broadened its mandate to include both research and extension activities in support of all farmers within a specific target area in the western Hills. Lumle's researchers are very active in on-farm research, combining it with their research carried out on the station. The socioeconomics division helps to coordinate the diverse on-farm research efforts and promote a farming systems perspective. Lumle pioneered the "group trek", or "samuhik bhraman", which is now used in several on-farm research programs in Nepal. Senior researchers periodically travel together out to field sites to interview farmers, identify production constraints, set research priorities, plan coordinated research programs, and monitor trials in farmers' fields.

5) The Pakhribas Agricultural Centre, located in the eastern Hills, is similar to Lumle in its history and mandate, but has organized its on-farm research quite differently. The agronomy section has the lead responsibility for on-farm research, and certain scientists are assigned to work full-time in regional field teams. Pakhribas also uses the "group trek" approach to plan research or address specific problems identified in the field, but treks are not carried out on a regular basis, as in Lumle.

Through the comparative analysis of these diverse on-farm research activities, the authors have been able to synthesize a rich body of management experience and draw out valuable lessons for organizing and managing on-farm research in national agricultural research systems.

In Chapters 1 and 2 the authors describe the context of agricultural research in Nepal. In Chapter 3 they systematically outline the organization and management of the five programs and then critically compare their strengths and weakness in conducting on-farm research.

In Chapter 4 the authors analyze the performance of the five programs in terms of the seven key functions of on-farm client-oriented research identified within the ISNAR study. For each program they examine the institutional factors that have either facilitated or impeded the performance of the function. Finally, in Chapter 5 the authors highlight the principal lessons to be drawn from the various on-farm research experiences and provide specific recommendations for further strengthening on-farm research on Nepal.

The wealth of experience in Nepal and the authors' detailed comparative analysis of the organization and management in the five district on-farm research programs makes the analysis and lessons of the study highly valuable to research managers and on-farm research practitioners working in a wide range of institutional settings.

Deborah Merrill-Sands
Study Leader

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Dr. Sudarshan B. Mathema first entered government service as a district agricultural officer and in 1977 was assigned by the government as the Chief Economist for the Cropping Systems Program of the Integrated Cereals Project. In 1985, when the Cropping Systems Program was institutionalized within the National Agricultural Research System, Dr. Mathema was appointed Chief of the Socio-Economic Research and Extension Division where he is currently serving.

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LIST OF ACRONYMS

AERP	Agricultural Extension and Research Project
APROSC	Agricultural Projects Service Center
CIMMYT	International Maize and Wheat Improvement Center
CIP	International Potato Center
CSP	Cropping Systems Program
DFAMS	Department of Food and Agricultural Marketing Services
DLDAH	Department of Livestock Development and Animal Health
DOA	Department of Agriculture
FFT	Farmer Field Trial
FSRDD	Farming Systems Research and Development Division
GDP	Gross Domestic Product
HMGN	His Magesty's Government of Nepal
HYV	High-Yielding Variety
IAAS	Institute of Agriculture and Animal Science
IARC	International Agricultural Research Center
ICP	Integrated Cereals Project
IF	Institute of Forestry
IRRI	International Rice Research Institute
KHARDEP	Koshi Hills Area Regional Development Program
LAC	Lumle Agricultural Center
NARSC	National Agricultural Research and Services Center
NARS	National Agricultural Research System
NRIP	National Rice Improvement Program
ODA	Overseas Development Administration
OFCOR	On-Farm Client-Oriented Research
PAC	Pakhribas Agricultural Center
PAS	Parwanipur Agricultural Station
PPVT	Pre-Production Verification Trial
RCC	Research Coordination Committee
RONAST	Royal Academy of Science and Technology
SERED	Socio-Economic Research and Extension Division
T&V	Training and Visit System
USAID	United States Agency for International Development

Currency Equivalents

The following are average annual exchange rates for selected years.

	US Dollar	Nepalese Rupee
1974-75	$ 1.00	NR 10.50
1975-78	$ 1.00	NR 12.45
1980-81	$ 1.00	NR 11.90
1982	$ 1.00	NR 13.10
1983	$ 1.00	NR 14.40
1984	$ 1.00	NR 16.30
1985	$ 1.00	NR 17.60
1987	$ 1.00	NR 21.90

CHAPTER ONE

NATIONAL CONTEXT FOR AGRICULTURAL RESEARCH

BRIEF OVERVIEW OF NEPAL AND ITS ECONOMY

Nepal is a landlocked kingdom located in the Himalayan Mountains of South Asia between 26°N and 30°N latitudes. Its northern border abuts the Tibetan Region of the People's Republic of China, while the remaining borders are with India. The country is roughly rectangular in shape with an average east-west length of 885 km and an average north-south width of 193 km. Total area of the country is 147,181 km.

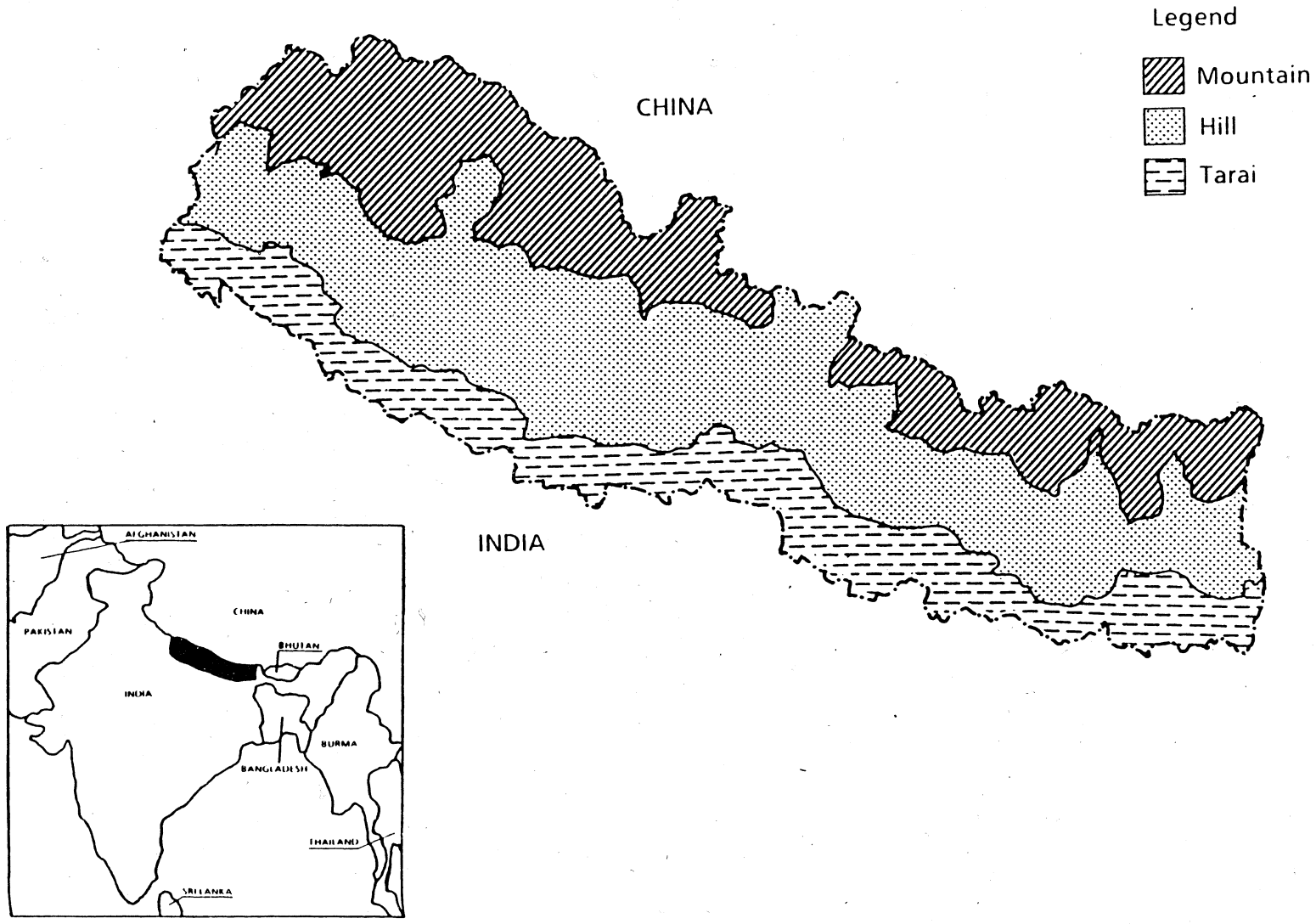
Topography

The topography of Nepal has been one of the critical factors in the evolution and development of a modern Nepal. Within the narrow span of its width, where altitudes range from 60 meters above sea level to over 8,000 meters, can be found all types of climates, from subtropical to alpine. Running east to west, major river systems originating in the Himalayas act as physical barriers to transportation and communication and have led to the development of relatively isolated social and cultural groups. Physically the country can be divided into three distinct, parallel geographic regions running east to west (Figure 1). Each region has its own unique agro-ecological characteristics.

Mountain region. This is the northern-most area. Lying the Himalayan Mountains, the altitude varies from 3,000 to 8,848 meters (the peak of Mt. Everest). Although this area occupies 51,000 km^2, or 35% of the total land area, 39% of it is under perpetual snow, with the snow line running at 4,877 meters. Approximately 9% of the country's population live in this area. Agricultural activities are limited to a minimal tilling of land and the raising of sheep, goats and yaks. Being remote and isolated, access to this area is very difficult and limited to walking trails and several high-altitude grass landing strips.

Hill region. The middle area is composed of two main hill ranges which enclose a large number of small valleys of varying altitudes, and many rivers and streams. Altitudes range from 300 to 3,000 meters. This region covers 62,000 km^2 (42% of the total land area), and new land for cultivation is limited. With 48% of the population living in the hill region, agricultural activities in this area are very intensive and varied and subsistence farming is predominant. The average hill farm is only 0.25 to 0.4 ha in size. Although many areas in this region experience food deficits, there is little intra-market exchange because of the topographical nature of the area and limited transportation facilities.

Figure 1: Agro- Ecological Regions - Kingdom of Nepal



Tarai region. The third and southern-most area is called the Tarai or flat plains. It is the northern most extension of the Indian Gangetic Plain. Here the altitude ranges between 60 and 300 meters. Covering an area of 34,000 km^2, or 23% of the total land area, the Tarai contains 44% of the population. With its fertile lands and relatively more developed infrastructure, the Tarai is the major producer of grain, cash crops, tropical fruits and vegetables. However, because of the limited transportation infrastructure in the Hill and Mountain Regions there is little interchange between the Tarai markets and the markets of the Hills and Mountains. The greater part of the surplus production in the Tarai flows across the border into India.

Demographics

In 1986 the total population in Nepal was 17 million with an average annual growth rate of 2.66% (Table 1). Population growth rates, however, are significantly different for the two most heavily populated geographic areas. In the Hill Region, the average annual population growth rate for the period 1971-1981 was 1.6%, while for the Tarai it was 4.1%. Much of this difference is the result of greater pressure on hill resources and the subsequent migration of hill people to the Tarai areas. Overall, only 7% of the population live in urban areas; 93% reside in rural areas where cultivatable land is scarce. With 693 people per km^2 of cultivated land, Nepal has one of the highest population densities for cultivated land in the world (APROSC, 1986). Again, there are significant differences between the Mountains, Hills and Tarai, with population densities per km^2 of cultivated land being 673, 871 and 579, respectively.

Table 1: Basic Demographic Statistics

	1965	1981	1986
Population (millions)	11.5	15.0	17.0
Population Growth rate (%)	2.0	2.6	2.7
Crude Birth Rate (per 1,000)	46.0	43.6	41.0
Crude Death Rate (per 1,000)	24.0	20.1	17.0
Fertility Rate	6.0	6.3	5.9
Child Mortality Rate (per 1,000)	184.0	144.0	130.0
Life Expectancy (years)	40.5	44.6	46.6

Source: World Bank, 1988

Of the total population, the economically active percentage is very low (47.5%) mainly as a result of the large proportion of young people in the population (USAID, 1987). It is estimated that more than 40% of the population is under the age of 15 (USAID, 1987). As the growth indicators below illustrate, this situation is likely to continue into the near future and in part forms the basis for population projections for the year 2000 which range from 21 to 22.6 million (NPC, 1985).

Table 2: Summary of Basic Features of the Three Agro-Ecological Regions

Region	Land Area '000 ha	Population '000[1]	Cultivated Land '000 ha[2]	Population per ha[2]	Irrigated Area '000 ha	Percent Irrigated	Main Crops/ Livestock
Mountains	5,185 (35)	1,303 (8.8)	208 (9)	6.73	26.4 (4.5)	12.7	Buckweat, barley, sheep, goats, yaks
Hills	6,153 (42)	7,163 (47.6)	904 (37)	8.61	146.9 (25.0)	16.3	Maize, millet, rice, cattle, goats
Tarai	3,410 (23)	6,557 (43.6)	1,299 (54)	5.79	414.5 (70.5)	31.9	Rice, wheat, cattle, buffaloes
Nepal	14,748 (100)	15,023 (100)	2,441 (100)	6.93	587.8 (100)	24.0	

Notes: 1 Data is for 1981.
2 Data is for 1985.
Figures in brackets are percentages.
Source: APROSC, 1986.

As a result of increased population pressure in the Hills, more and more marginal lands have been brought under cultivation, forests are being denuded with the increased demand for fuelwood, and upland pastures are being overgrazed. These actions have caused repercussive ecological disturbances with increased land slides and soil erosion in the Hills, and floods in the Tarai (NPC, 1985).

Economic Development

Economic development in Nepal is synonymous with the development of the agricultural sector, which dominates the economy. In 1985, the average per capita annual income was US$ 160 (Table 3). The reality of the economic situation in Nepal becomes more distinct when one considers the imbalance in economic development between the Hills, Mountains and Tarai. In the Hill and Mountain areas the per capita income is estimated at only US$ 40-60 while Kathmandu Valley, the capital, is approaching US$ 600. This has made Nepal one of the poorest countries in Asia and designated one of the least developed countries in the world by the World Bank.

During the period 1965 to 1980, the GDP grew at a relatively constant rate of 2.3% per year, except for the five-year period from 1970 to 1975 when the GDP growth rate dropped to 1.9% per year. At present, it is estimated that the GDP is growing at 4.2% per year. On average, the annual GDP growth rate for the last 20 years is 2.7%, a figure which is low compared to other countries in the region.

Table 3: Basic Economic Statistics

	1965	1985
GDP (million US$)	730	2,290
Per Capita GDP (US$)	60	160
Sector Contribution to GDP (%)		
Industry	11	12
Agriculture	65	56
Manufacturing	3	4
Services	23	32

Source: World Bank, 1986

In terms of industrial development, given India's much greater level of development, transport network, locational advantage and established productive capacity, most things Nepal can produce are not competitive with Indian goods in the Indian market, or even in Nepal's own shallow domestic market. With over 70% of actual imports/exports from/to India, under current conditions there is no way to effectively restrict trade from the Nepalese side of the border (USAID, 1987).

THE AGRICULTURAL SECTOR -- AN OVERVIEW

The Agricultural Sector

Nepal is predominantly an agricultural country. The majority of the country's population are dependent upon the agricultural sector for their livelihood, with 93% of the labor force engaged in agricultural activities. In 1985-86, the agricultural sector accounted for 59% of the GDP (60% of all exports) and provided, on average, 1,900 calories per person, which was 83% of the total daily requirement (World Bank, 1988). In addition, more than 90% of all industrial raw materials come from the agricultural and forestry sectors.

Since 1970, agricultural production has grown at an annual rate of only 1%. Even then, this slow growth in agricultural production is more a result of the expansion in cultivated area than of increased productivity.

Agriculture and Development

The government has continuously given priority to agricultural development in the national development plans, but despite real increases in investment levels little growth has been achieved in the agricultural sector (ADB/HMGN, 1982). Many reasons have been suggested for this lack of growth, including bad weather, ineffective extension services, inappropriate agricultural technology, lack of sufficient agricultural inputs and credit, and the complexity of the many small, fragmented farms (Baskota, 1986; ADB, 1982).

The present five-year plan (1985-90) has emphasized the development of a self-sustaining agricultural base for the different regions, stressing the development of simple, low-cost agricultural technologies that can be extended to the majority of farmers. Continued emphasis has also been placed on the development of the necessary infrastructure for agricultural development, e.g., roads, markets, irrigation systems and input delivery systems.

The Natural Resource Base

Land use. The latest estimates on land use[1] (1985) indicate that 24,110 km^2 or 16.4% of the total area is cultivated, while forests account for 42.1% (Table 4). The prospects of additional land being brought under cultivation are extremely limited as much of the land recently brought under cultivation is of marginal quality.

---

1 Until recently, definitive data on physical land use has not been available. Figures used in this report are the latest figures available from the Land Resources Mapping Project which has used satellite photos to develop an accurate assessment of the country's resources. This land use information has recently been accepted for official use by the government.

There are few known exploitable natural resources in Nepal other than forest and water resources. Nepal's forests, under existing government laws, are viewed largely as something to be protected rather than commercially exploited. On the other hand, water resources can be exploited for the production of hydroelectric power. However, the further development of hydroelectric generating capacity, for which there is great scope, would be dependent upon sales of electricity to India. It is this lack of natural resources that has seriously constrained economic development.

Table 4: Major Land Use Activities

Land Use	Area in '000 ha				Percent
	Mountain	Hill	Tarai	Total	of Total
Cultivated	208	904	1,299	2,411	16.4
Forest	1,408	3,251	1,542	6,201	42.1
Grazing	1,137	546	74	1,757	11.9
Roads and Settlements	10	83	100	193	1.3
Snow Covered	2,007	141	--	2,148	14.4
Other (Barren land, water covered, etc.)	415	1,228	395	2,038	13.8
Total	5,185	6,153	3,410	14,748	100.0

Source: APROSC, 1986.

Farm Holdings by Land Size

Land ownership in Nepal is highly skewed with the majority of farmers having less than 1 ha (Table 5). Land fragmentation is a serious constraint to agricultural development, especially in the hill areas where individual fields may be more than half a day's walk from the farmstead and across a vertical distance of up to 1500 m. Since traditional inheritance practices encourage land fragmentation rather than consolidation, many of the farms are no longer capable of producing surplus production for marketing let alone providing a family with a year-round supply of food.

Table 5: Farm Holdings by Land Size

Size of Holding (ha)	Number of Farm Households	Percent
0.0 - 0.5	1,099,677	50.1
0.5 - 1.0	355,420	16.2
1.0 - 2.0	379,051	17.3
2.0 - 3.0	156,961	7.2
3.0 - 5.0	119,669	5.4
5.0 - 10.0	60,082	2.7
Above 10.0	14,872	.7

Source: CBS, 1985.

Larger farms tend to be concentrated in the Tarai where either the land is hired out to sharecroppers or is farmed by employing agricultural laborers.

Main Agricultural Commodities

Crops. Rice, maize and wheat are the three most important cereal crops in Nepal, occupying approximately 53%, 23% and 18% of the cultivated area, respectively. Other minor crops include millet, barley, buckwheat and amaranthus. Potatoes, pulses and vegetables are important food crops and are key components in both Hill and Tarai farming systems. Nonfood cash crops such as jute, tobacco, oilseeds and sugarcane account for 10-12% of the total cropped area.

Rice and wheat are the dominant crops in the Tarai, accounting for 65% and 25% of the cultivated area, respectively. In the Hills, maize, rice and millet are the primary crops, covering 38%, 28% and 18% of the cultivated area, respectively.

Productivity with respect to these crops, except for wheat, has been stagnant or declining. Wheat has shown minor growth in productivity but this has been insignificant when compared to the productivity increases in other countries within the region. Crop yields for all major crops are lower, not only in absolute terms but also relative to those in other Asian countries. For example, rice yields in Nepal were the highest in South Asia in 1966 but are now one of the lowest in the region. Average maize and wheat yields have followed more or less the same pattern (ADB, 1982).

Between 1969-70 and 1981-82, the national average yields have varied between 1.6-2.1 t/ha for rice, 1.3-1.6 t/ha for maize, and 0.8-1.3 t/ha for wheat. Due to the erratic nature of the monsoon rains and the heavy dependence on rainfed agriculture, wide fluctuations occur in production, making it difficult to ascertain long-term growth trends. Table 6 shows the changes in area, production and yields for the major crops by agro-ecological region for the period 1975 to 1985. Of particular importance is the desperate situation found in the Hills and Mountains. What little increases in production there have been are the result of more and more marginal land being brought under cultivation.

In 1985/86, the area planted to rice was 1.391 million ha, which accounted for 50% of the total area planted to cereal crops, while maize and wheat accounted for 22% and 17%, respectively (Table 7).

Area expansion has been the main source of increases in production but the scope for future expansion of cultivated land in the country is severely limited. Consequently, any major increases in production will have to come from improvements in yields and crop intensification (Pudasaini, 1984).

Horticulture. The potential for fruit and vegetable development within the country has yet to be fully exploited. Temperate fruits, with good quality and taste, can be grown in the high Hill areas as has been demonstrated in a few sites. Citrus is common in the mid-Hills and tropical fruits in the Tarai. With the wide range of climates found in Nepal there is also potential for the development

Table 6: Area Planted, Production and Yields for Major Crops by Agro-ecological Region (1975-1985)

	Area Planted '000 ha			Total Production '000 metric tons			Yield (kg/ha)		
Mountain:	1975	1985	% change	1975	1985	% change	1975	1985	% change
Rice	21.6	30.3	40.3	46.7	53.5	14.6	2162	1766	-18.3
Maize	42.1	45.5	8.1	78	68	-12.8	1853	1495	-19.3
Wheat	22	25.7	16.8	21	23.6	12.4	955	918	-3.8
Millet	16.6	20.3	22.3	20.1	19.2	-4.5	1211	946	-21.9
Barley	9.5	9.8	3.2	9.8	8.3	-15.3	1032	847	-17.9
Hills:	1975	1985	% change	1975	1985	% change	1975	1985	% change
Rice	195.8	288.3	47.2	489.6	581.2	18.7	2501	2016	-19.4
Maize	275.2	384.1	39.6	506.5	523.5	3.4	1840	1363	-25.9
Wheat	91.6	167.8	83.2	101.4	193.5	90.8	1107	1153	4.2
Millet	88.8	102.8	15.8	104	94.2	-9.4	1171	916	-21.8
Barley	10.4	13.3	27.9	10.2	11	7.8	981	827	-15.7
Tarai:	1975	1985	% change	1975	1985	% change	1975	1985	% change
Rice	1023.5	1048.8	2.5	1954.7	2122.2	8.6	1910	2023	6.0
Maize	137.4	136.1	-.9	211.6	226.8	7.2	1540	1666	8.2
Wheat	184.2	275.4	49.5	219.6	371.4	69.1	1192	1349	13.1
Millet	19.9	13.2	-33.7	18	12.3	-31.7	905	932	3.0
Barley	7.3	4.2	-42.5	5.2	3.8	-26.9	712	905	27.0
NEPAL	1975	1985	% change	1975	1985	% change	1975	1985	% change
Rice	1240.9	1367.4	10.2	2491.0	2756.9	10.7	2007	2016	.4
Maize	454.7	565.7	24.4	796.1	818.3	2.8	1751	1447	-17.4
Wheat	297.8	468.9	57.5	342.0	588.5	72.1	1148	1255	9.3
Millet	125.3	136.3	8.8	142.1	125.7	-11.5	1134	922	-18.7
Barley	27.2	27.3	.4	25.2	23.1	-8.3	926	846	-8.7

Note: Figures for 1975 and 1985 are three year averages.
Source: DFAMS, 1986.

Table 7: Area and Production of Cereal Crops (1985/86)

Crop	Area (ha)	Percentage of total cereal crop area	Production in metric tons	Percentage of Production
Rice	1,391,000	50	2,804,000	62.0
Maize	615,000	22	874,000	19.0
Wheat	483,000	17	598,000	13.0
Millet	151,000	5	138,000	3.0
Barley	26,000	1	23,000	0.5
Others	134,000	5	113,000	2.5
Total	2,800,000	100	4,550,000	100.0

Source: DFAMS, 1986.

of vegetable and flower seed production programs as an important enterprise for Hill farmers. However, the lack of an organized marketing network coupled with inhibited growth in the private sector have been the main factors that have limited growth in the horticultural sector.

Livestock. Livestock are an integral part of the subsistence farming systems prevalent in Nepal and are important for draft power, manure and livestock products. Although livestock play an important role in the farming systems of Nepal their productivity remains very low. Livestock production accounts for 21% of the total agricultural output (25% of agricultural GDP) in the form of milk, ghee (clarified butter), manure and skins. It is estimated that the livestock population includes 6 million cattle, 3 million buffalo, 5 million goats, 1 million sheep, 0.5 million pigs and 8 million poultry, giving Nepal one of the highest livestock populations per unit of cultivated area in the developing world. The average farm family in the Hills maintains 3.7 cattle, 1.9 buffalo, 2 goats and 8 chickens (ADB, 1982). Livestock and crops are so interdependent that in some cases new improved varieties of cereals, even higher-yielding varieties, have been rejected by farmers because of their low straw-yielding qualities.

Forestry. Forests in Nepal cover 5.6 million ha, approximately 42% of the total land area (APROSC, 1986). Forests at all elevations are used by the rural people for their basic fuel wood needs as well as for fodder and timber. It is estimated that 75% of all fuel wood is supplied by the forests and shrub lands as well as 70% of all livestock feed in the form of forest litter, grasses and brush. Nepal's forests are also rich in medicinal plants, herbs, natural nuts and fruits as well as other forest products and by-products. Existing government laws encourage protection of the forests rather than their effective and proper utilization. The forests could be commercially exploited and utilized for income generation if the government encouraged the private sector to manage the forest resources and restrict over-reliance on state-owned enterprises which are not effective.

Major Organizations Involved in the Development and Transfer of Agricultural Technology

Agricultural research. Until recently, agricultural research in Nepal was conducted by different departments and programs within the Ministry of Agriculture with little coordination and cooperation. In 1985, a major reorganization of the agricultural research program was undertaken with all research activities related to agriculture being placed under a newly created National Agricultural Research and Services Center (NARSC) (Chart 1).

Two autonomous, British Government-funded and -managed agricultural research centers, Lumle and Pakhribas, are also actively involved within the national agricultural research system. Both have been technically integrated within NARSC and participate fully in all national programs. In addition, the Institute of Agriculture and Animal Science and the Institute of Forestry, part of the Tribhuvan University, conduct agricultural research which is coordinated with the national program through a ministry-level Research Coordination Committee.

Extension services. The extension system in Nepal does not have a uniform pattern throughout the country (ADB, 1982). A variety of extension methodologies have been introduced by various foreign-aid projects in different parts of the country. Some programs, such as the two autonomous British-funded agricultural centers, have developed independent extension programs to support their center's activities.

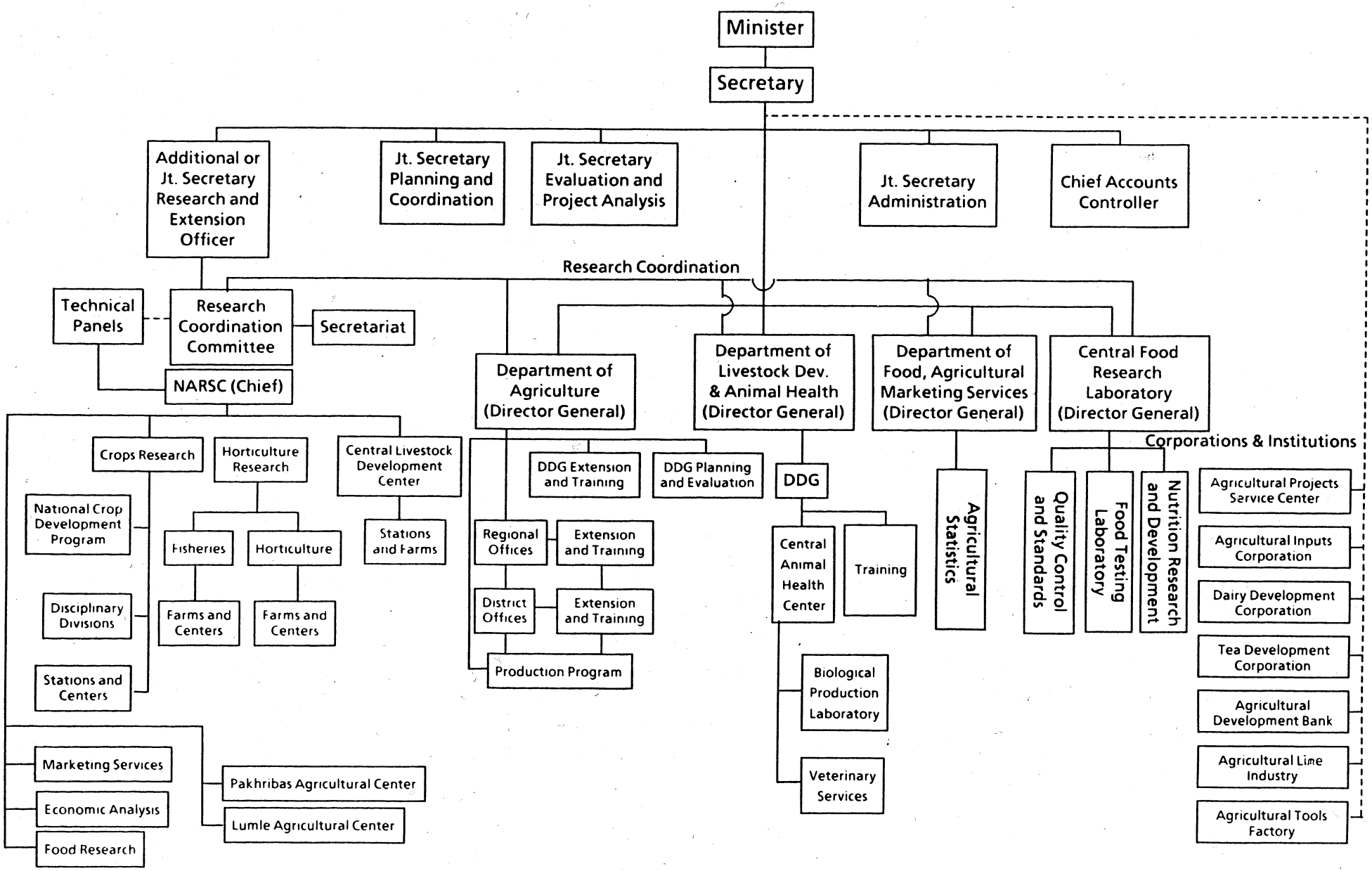
National extension activities in Nepal are the responsibility of the Extension and Training Section of the Department of Agriculture. The section is headed by a deputy director general (Chart 1).

For administrative and developmental purposes, the country has been divided into 75 districts which are grouped into five development regions. Each development region bisects the three agro-ecological regions to ensure balanced development. At the district level, the district headquarters (usually the largest village) has offices representing all the major line agencies. For agriculture, this is the district agricultural development office, which is headed by an agricultural development officer and which has a staff of extension agents responsible for extension programs within that district. Extension staff are assigned to specific areas within the district.

In several districts where the training and visit system has been introduced,[2] the agricultural development officers are supported by two subject-matter specialists as well as local farmers who are hired as agricultural assistants to work with contact farmers. In those districts, agricultural service centers have been constructed which integrate the services of the agricultural extension staff

2 The training and visit system of agricultural extension was first introduced in 1975 under a World Bank/IDA-financed irrigation project in six Tarai districts. It was expanded further under another IDA-financed project in 1981 to include an additional eight districts.

Chart 1: Present Structure of the Ministry of Agriculture



with those of the Forestry Department, cooperatives, Agricultural Development Bank and Livestock and Animal Health Department.

At the regional level, there is an agricultural regional directorate. The regional director of agriculture (normally a first-class post) is responsible for coordinating the district agricultural offices' programs with the agricultural research stations and farms, the Agricultural Development Bank, and cooperatives within the region through an annual planning process which involves the district agricultural development officers and heads of the various programs. The regional agricultural directors participate in annual national research seminars which are the only formal linking mechanisms between research and extension.

Institutional Support Services for Agriculture

Input supply. The procurement and supply of agricultural inputs (seeds, fertilizer and chemicals) is solely a function of the Government's Agricultural Inputs Corporation, a government parastatal organization. As the country has no resources to produce chemical fertilizer, supplies are procured on the international market and through donor-assisted programs. However, the insecurity of aid program commitments makes it difficult to formulate a long-term import program. Late arrivals of fertilizer shipments from outside and difficult internal transportation limits the amount of fertilizer that can be effectively marketed. The prices of chemical fertilizers and agro-chemicals sold in Nepal are fixed by the government and are uniform throughout the country. The prices are subsidized to the extent of 45% to 50% of the cost. In addition, the Agricultural Inputs Corporation is paid a transportation subsidy for distribution to remote areas. The corporation sells agricultural inputs on a wholesale basis through a system of government cooperatives. In 1985, average fertilizer consumption for all Nepal was only 11.2 kg/ha, yet the consumption figures are highly skewed, with 50% of the fertilizer being used in the Tarai, 34% in Kathmandu Valley and the remaining 16% in the Hills (APROSC, 1986).

Credit. The government's Agricultural Development Bank is the major institutional source of agricultural credit and has a network of 232 field-level offices throughout the country. Major commercial banks also have special agricultural-sector programs which provide credit under government guidance. The effectiveness of credit programs has been hampered by procedural difficulties which limit access to farmers along with late repayments and loan defaults.

Cooperatives. Cooperative societies act as the commission agents for the sale of seeds and fertilizer from the Agricultural Inputs Corporation. In addition, many cooperatives provide loans to members as well as marketing consumption goods and agricultural produce. Approximately 700 cooperative societies have been created throughout the country. Most cooperatives are managed by a locally elected management committee of which two-thirds must be small farmers. The Agricultural Development Bank exercises financial control over the cooperatives.

Irrigation. Nepal has abundant water resources for irrigation (surface sources from the Himalayan Mountains and ground water resources in the Tarai) but only a small proportion has been utilized. It is estimated that all cultivated land could be provided with year-round irrigation.

Eighty percent of the rainfall is received during the four-month monsoon season from June to September, which provides 75% of the total annual river flows. The development of year-round irrigation is therefore very expensive given the topographical constraints and the storage costs of water during no-Monsoon periods. At present, the total irrigated area (irrigated for at least one season) is approximately 590,000 ha, which represents nearly 24% of the total cultivated area (Table 8). The area under perennial irrigation is much lower. Of the total irrigated area, 70.5% is in the Tarai, 25.5% in the Hills, and 4.5% in the Mountains. Public sector irrigation programs account for 26% while community and farmer systems account for 74% of the total irrigated area (APROSC, 1986).

Table 8: Irrigated Area by Region (ha.), 1986

Mountains	Hills	Tarai	Total
26,400	146,900	414,500	587,880
4.5%	25%	70.5%	100.0%

Source: APROSC, 1986

Roads. The development of a usable road network connecting the various geographical areas of the country has been a top priority for the past 25 years. However, because of the topographical conditions, road construction is very expensive and also difficult to maintain after construction. In 1983, out of 75 districts only 41 were linked by motorable roads, much of which were fair-weather roads with limited access during the rainy periods.

The present road network consists of one main east-west road running through the northern part of the Tarai. This road has many small feeder roads linked to the Indian border and Indian railheads. North-south links with the east-west highway in the hill regions have been established in some areas and plans for the construction of additional link roads into the hill areas is underway.

Nepal has a total of 6,280 km of roads, of which 2,673 km are asphalted, 873 km gravelled, and 2,737 km are classified as fair weather roads (APROSC, 1986).

Agricultural markets. The lack of an effective transport system combined with the topographical nature of the country has resulted in highly fragmented agricultural markets. This has in turn led to price variations which cannot be justified by transport costs (APROSC, 1986). Foodgrain markets are often dominated by a few large traders and millers. Price distortions and reduced returns to

producers are common. Though the government has initiated a minimum price-support policy, it has not been effective due to 1) the late announcement of minimum support prices, 2) the lack of an efficient procurement network, and 3) lack of funds to procure foodgrains when maximum sales are expected to occur. In addition, the open border with India has an important impact not only on prices but also on foodgrain movements.

TECHNOLOGICAL CONSTRAINTS TO AGRICULTURAL DEVELOPMENT

Agricultural development in Nepal has been constrained by its geographic situation, topography, limited development of water resources for irrigation and low soil fertility. In addition, the availability of appropriate technology, especially for rainfed and hill conditions, has been limited, and the planning and coordination of development programs at the field level has been weak. Extension services have been ineffective because of the lack of strong cooperative linkages with the agricultural research programs, and this has limited the communication of new technology. Government extension programs have been hindered by low staff morale, as well as limited training and support facilities at the field level.

While many of the above constraints are common to all three of the agro-ecological regions, many constraints to agricultural development in the three regions have been different. These are discussed in more detail below.

Constraints in the Mountains

Agricultural development in the Mountain Region is a very difficult task. Population settlements are widely scattered in semi-isolated pockets, and transportation and communication between these settlements is almost nonexistent. The harsh agro-ecological conditions of the Mountains and their fragile environment has created a "push factor" which has led to high rates of seasonal migration (in some areas up to 70%) and, increasingly, to permanent migration to the Hills and Tarai Regions. While agricultural opportunities are limited, there is room for the development of livestock and horticulture activities. Transportation obstacles, however, have to be overcome to allow the development of these activities and the markets which will be required to make these programs effective. At present, there is limited research on high-altitude varieties of livestock (Yaks and mountain goats) and horticultural crops.

Constraints in the Hills

In the Hills, farming systems are complex. There are a number of constraints which have slowed down the adoption of improved technologies. One of the major constraints to increasing yields of the major crops is the lack of plant nutrients. Inadequate irrigation facilities and damage caused by insect pests and diseases are also contributing factors. Farmers also report problems with weather, including hail and flood damage, lack of labor and animal power at peak agricultural periods, lack of capital, etc. Another major constraint is the farmers' lack of knowledge about newly recommended technologies and the benefits that they can derive from

using them. On average, one extension agent has to provide services to more than 2,500 farm households. Many constraints also arise from the lack of organization and coordination in the concerned agencies and institutions (CSP, 1978).

Constraints in the Tarai

As a result of the different socio-economic and agro-climatic conditions in the Hills and Tarai, technological constraints to agricultural development also differ. In the Tarai there is greater homogeneity, more fertile soil and better irrigation facilities, as well as access to roads and organized markets which provide the farmers of the Tarai with more incentives. The constraints to agricultural production that do exist are related to the untimely and insufficient delivery of inputs, inadequate extension services and the lack of price incentives to producers. Consequently, more agricultural development programs have been successful in the Tarai than in the Hills.

Development and Research Policy Constraints

Past policies on agricultural production have concentrated assistance in the resource-rich areas in the Tarai Region. Agricultural research policies have been oriented to support this production strategy. This is best illustrated by the three most important agricultural research stations being located in the Tarai and concentrating their activities primarily on the agro-climatic conditions of the Tarai and adjoining hill areas. Development of physical infrastructures, most notably irrigation and input supply facilities, have received a much higher priority in the Tarai than in the Hills. Until recently, the government's strategy for commodity development priorities concentrated on livestock activities in the Mountains, horticultural enterprises in the Hills, and food and cash crops in the Tarai. However, the relatively poor performance of the agricultural sector in the past few years, coupled with higher than anticipated population growth, has led to a new government strategy which is now focusing on increasing food production in both the Hill and Tarai areas.

CHAPTER TWO

AGRICULTURAL RESEARCH AT THE NATIONAL LEVEL

OVERVIEW OF AGRICULTURAL RESEARCH IN NEPAL

Historical Development of the Agricultural Research Program

Government involvement in agricultural development started in 1924 with the opening of a Department of Agriculture and the establishment of a demonstration farm at Singha Durbar in Kathmandu and a fruit nursery farm at Godavery in nearby Lalitpur (Yadav, 1987). During the 1950s and early 1960s, a number of disciplinary divisions were established in Kathmandu, while in other areas of the country several agricultural farms and stations were established. Agricultural farms were created as single-purpose units which concentrated on a single activity such as crops, horticulture, fisheries or livestock. Agricultural stations, on the other hand, were designed to be multipurpose units which concentrated on several activities, such as crops, livestock and horticulture.

During this period, both the government and donor agencies believed strongly in the extension of new technologies to farmers and in providing support services to accelerate their adoption. Work at the agricultural farms and stations provided much of this support in the form of on-station seed multiplication programs, demonstration trials and multilocational testing. Expectations for development were centered on increasing production and productivity through a process of technology transfer and diffusion. Extension staff, believing that extension was ahead of research in Nepal, relied on research information and inputs (especially new crop varieties) coming from India's research programs for agricultural development. Programs utilizing village-level workers were activated using a block development approach, and a village development training center was opened in Kathmandu in 1952 with assistance from the United States Agency for International Development (USAID). Extension and training were emphasized along with fixed production targets.

The newly created disciplinary divisions had the primary responsibility for agricultural research, which was focused on adaptive research, as laid down in the general outline of the First Five-Year Plan for Agricultural Development in 1957. During this period, new varieties of cereals and vegetable crops as well as superior breeds of livestock were brought into Nepal mainly through the initiative of foreign donors and advisors. These new technologies were then tested by the disciplinary divisions and

agricultural farms/stations and released. The varieties thus released were Lerma-52 and the NP series wheat varieties, Cubano Flint maize, the rice variety CH-45 and other Japonica varieties of rice.

In 1965-66, an intensive, coordinated agricultural development program was initiated with USAID assistance in nine districts that had been identified as having high production potential. This program was further reinforced by a regional program of the Department of Agriculture in 1966 for selected regions. Research staff from government stations and extension personnel from each region were collectively responsible for the agricultural development within each region. The program continued to emphasize extension activities using field demonstrations. The primary objectives of the demonstrations were to show the impact of fertilizer use on production and the benefits from using intensive production techniques.

With the land reform program providing the farmers with more incentives to produce and with the establishment of village cooperative societies to supply the necessary inputs and credits, it appeared that Nepal was ready for "take off" with an extension program that would make a real impact on production (Carter, 1965).

Shift in research emphasis. In the late 1960s and early 1970s there was a shift in the emphasis of agricultural development. In addition to the existing support for technology transfer and extension techniques, there was a growing awareness of the need to strengthen the adaptive agricultural research program. This change in emphasis was the result of several events:

1) In 1966, the government created the Department of Agricultural Education and Research and assigned it the responsibility for crop research.

2) At the same time, a growing number of Nepalese researchers were returning from training programs offered by the international agricultural research centers (IARCs), such as IRRI and CIMMYT as well as IACP in India. Not only did these young researchers bring new skills and practical field experience, but they also brought a number of new varieties[1] for testing and introduction in addition to a large number of breeding lines for development and selection under local conditions.

3) Also during this time a number of internationally respected agriculturalists came to work in Nepal through various

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1 CIMMYT wheat varieties Lerma Rojo-64, Pitic-62, Sonora-64, S-227, Kalayan Sona and S-331 were directly introduced from IARCs. Also from CIMMYT, the maize varieties Khumal Yellow, Kakani Yellow and Rampur Yellow were directly introduced but given Nepalese names. The rice varieties Taichung-176, Chinan-242, Taichung Native-1, IR-5 and IR-8 were also directly released.

donor-funded programs.[2] These advisors, recognizing the limitations of the extension/diffusion approach, emphasized the need for increased adaptive research efforts and the development of improved agricultural technologies which would be relevant and acceptable under local conditions.

4) The program objectives and funding priorities of the donors began to change with the increased recognition of the need to establish research competence in agricultural development and for a multidisciplinary approach in testing new technologies in farmers' fields.

Strengthening of applied and adaptive research capacity. After this shift in emphasis in agricultural development, resources from donor-funded projects began to be diverted away from extension programs and directed to expanding and strengthening the research facilities at several agricultural stations in the Tarai.[3] With the improvements in the applied and adaptive research working facilities, the research programs established indigenous breeding programs for wheat, maize and rice in addition to the evaluation and selection of material coming into the country from IRRI, CIMMYT, CIP and the Indian research programs. During 1970-71, 1200 local rice varieties along with several local maize and wheat varieties were identified and collected from all over Nepal and tested for their performance.

With the improvements in the research facilities, a national commodity program was initiated and institutionalized in 1972 for the three major cereal crops: rice, wheat and maize. Each of these programs was attached to one of the major research stations in the Tarai. Using a station-based multidisciplinary team comprised of an agronomist, plant breeder, plant protection officer and soil scientist drawn from the disciplinary divisions, the teams were designed to work in a coordinated manner for the specific research activities of an individual crop. Linkages with the parent disciplinary units from which the commodity team staff were drawn have been maintained by the programs.

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2 In 1967 Glen Johnson arrived as an agronomy advisor for the USAID-funded Foodgrain Technology Project. He emphasized the need for increased research on the development of agricultural technologies adapted to local conditions (Simmons et al., 1982). In October of 1969, Raymond Foot became the chief of the Food and Agricultural Division of the USAID Office in Kathmandu. One of his priority items was to create research competence in the field of agricultural development (USAID, undated). Dr. Glen Anderson from CIMMYT made many visits to Nepal during the late 1960s. He continually emphasized the need for multidisciplinary testing of new technologies in farmers' fields.

3 The agricultural stations that received major support from donor-funded programs were located at Rampur, Janakpur, Bhairawa and Nepalgunj. These stations are all located in the Tarai Region.

Socio-economists were not included in the teams at the commodity centers. One of the major reasons for this exclusion was that the roles and responsibilities of the socio-economists had not been defined to include implementation of research programs or assessment of research impact. Another reason was the limited number of socio-economists and their involvement at the ministerial level in the prosesses of planning and data collection.

Initiation of on-farm trials. After the establishment of the crop commodity program, farmer field trials (FFTs) were implemented in 1973. These research trials were initially designed for multilocational testing and national-level evaluation for wide adaptability of new crop varieties, but they have since taken on a more specific regional role. Since the program's inception, farmer field trials have been developed by the commodity teams at the centers and implemented and managed by scientists from the agricultural farms and stations located throughout the country in collaboration with extension personnel at the field level. Results of these trials under farmers' conditions are reported back to the research staff at the commodity programs. These results are compiled by the individual commodity programs, and the performance of new varieties and technologies is evaluated from a national perspective. During the early period of the program, the majority of farmer field trials were implemented in the Tarai Region because it was the most compatible area for the technology that was then coming in from the IARCs.

Evaluation of the agricultural research program. In 1975, a high-level team from the Rockefeller Foundation made a study tour of the agricultural research and development projects in Nepal to observe and evaluate their performance. The evaluation indicated that many of the projects were unsuccessful due to researchers' lack of awareness of farmers' problems and conditions (Rockefeller, 1975). Yield gaps between on-station trials and on-farm production were high and on-farm trials designed specifically for the different agro-ecological regions were almost nonexistent. The study further indicated that there was only a limited probability of achieving success in increasing cereal production through the transfer of technologies developed in one specific agro-ecological region -- the Tarai -- to other areas in the Hills and Mountains. The need for verifying the performance of new varieties and technologies in farmers' fields in the different agro-ecological regions was emphasized.

Development of regionally focused programs in the Hills. As a result of the evaluation, the government requested the two autonomous British agricultural centers, located in the eastern and western Hill regions, to expand their operational mandate to include working with all farmers within their target areas rather than just providing extension and training for returning British Gurkha soldiers. Using inputs from the national commodity programs as well as local material and practices collected and identified from their own target areas, the Lumle and Pakhribas Centers have developed research programs which focus on problems specific to their respective areas.

Development of a cropping systems approach. The report of the Rockefeller study team was also a key factor in the development of the Integrated Cereals Project[4] in 1976. This project was designed not only to improve the basic and adaptive research capability of the commodity program but also to develop and implement a cropping systems program. The Cropping Systems Program was established as a unit within the Agronomy Division and received technical and financial assistance from the Integrated Cereals Project. The program, which included socio-economists, developed various techniques for the further verification and assessment of new varieties, technologies and inputs from the commodity programs as well as disciplinary divisions for site-specific and cropping pattern-specific adoption in defined agro-ecological areas.

After four years of operation, the Cropping Systems Program produced a series of uniform pre-production verification trial (PPVT) guidelines. These were based on the results of the on-farm trial work at cropping system sites and were designed for use by other agricultural development projects and institutes doing agriculturally related research. These guidelines, along with the many research staff who visited the Cropping Systems Program's testing sites, caused the livestock, horticulture, fodder and pasture, and cash crop programs to verify their new technologies in farmers' fields.

Change to farming systems approach. Experience gained from the Cropping Systems Program toward the end of the project period, especially as a result of the many socio-economic surveys, indicated the limitations of a cropping system-based methodology for Nepalese conditions. These socio-economic studies highlighted the importance of livestock in the farming systems of small subsistence farmers, especially in the mid-Hills. Because the role of livestock is so important, there were significant problems between livestock and crop production activities which limited the effectiveness of the Cropping Systems Program's recommendations. This experience, at the termination of the Cropping Systems Program in 1985, led the government to establish a Farming Systems Research and Development Division (FSRDD) and a Socio-Economic Research and Extension Division (SERED) as disciplinary divisions within the national agricultural research system. Both of these new divisions have received continued support from USAID.

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4 The Integrated Cereals Project was funded by USAID and implemented by the International Agricultural Development Service. Project activities began in 1977 and ended in 1985. A follow-up project, the Agricultural Research and Production Project, was developed by USAID to continue many of the major activities of the Integrated Cereals Project's Cropping Systems Program. The Agricultural Research and Production Project has concentrated its efforts on strengthening the newly established National Agricultural Research and Services Center in addition to continuing to provide support to the commodity programs and the production programs initiated under the Cropping Systems Program.

Building upon the work of the Cropping Systems Program, a whole-farm approach is now being implemented. This change was also in line with IRRI's change from a Cropping Systems Network to a Farming Systems Network in recognition of the role that livestock play in rice-based farming systems. Efforts are now being made by the new Farming Systems Research Development Division to integrate research on livestock, agro-forestry, pasture, soil fertility maintenance, forage, horticulture and cash crops into a farming system approach at selected farming system research sites.

The most recent innovation in agricultural research in Nepal has been the development of the "combined trek" approach. First used by the Pakhribas and Lumle Agricultural Centers in 1985, this technique is now used by the national farming systems research program as well. It involves researchers from different disciplines and centers coming together to visit groups of farmers in the field. While in the field, researchers and farmers interact to identify and understand the problems faced by farmers, set research priorities and design appropriate on-farm trials in direct consultation with the farmers themselves. This process has resulted in more timely decisions, better identification of farmer problems and more appropriate trials. It is now considered to be the most important methodology in the farming systems research process in Nepal.

Use of minikits as a research/extension methodology. In addition to their coordinated work with the Cropping Systems Program, the commodity programs launched a Minikit Program in 1977. The minikits were designed with a research/extension purpose. Each of the three major commodity programs produced small packets containing seeds of one or more new varieties (including pre-release varieties), instructions, a result feedback card and, in some cases, fertilizer and insecticide. Thousands of these kits have been distributed free to farmers through the extension service each year. Through this method, new varieties have been disseminated quickly and farmers have become familiar with the new technology. Seeds of new varieties liked by farmers receiving minikits have been distributed by these farmers to other farmers through the farmer-to-farmer seed exchange process. As an extension tool, the minikits have been very successful; however, their use as a research tool has been minimal. Feedback from minikit farmers on the performance of the new varieties under their own local conditions has been poorly monitored by the research and extension staff, with only good results being returned.

Donor Support for Agricultural Research

There are presently 32 foreign-aided projects in Nepal, funded by 13 different foreign donors. These projects involve agricultural research, resource assessment and data acquisition. Generally, external agencies support agricultural research on the basis of a project, rather than a program, approach. This has caused both distortions in the allocation of research resources and conflict among project and nonproject staff due to differences in opportunities (training) and privileges (salaries and benefits) throughout a program. For instance, under the Integrated Cereals Project, USAID support was limited to three major foodgrain crops, namely, rice, wheat and maize, and was not extended to livestock or horticulture. USAID has been the major donor agency to support

agricultural research in Nepal, contributing more than US$23 million from 1957 to 1984 to assist in establishing research and extension systems. The main emphasis of the USAID programs has been on increasing the production of foodgrain crops by providing technical assistance, equipment and material, and training (Yadav, 1987).

The recent changes in the national agricultural research system (discussed below) are intended to coordinate the technical and financial support from the various donors for a more balanced development of the agricultural research programs. More emphasis is being placed on the development of the overall research program rather than on individual components.

STRUCTURE AND ORGANIZATION OF THE NATIONAL AGRICULTURAL RESEARCH SYSTEM

Present Structure of the national agricultural research system

As part of the Ministry of Agriculture's active role in strengthening the national agricultural research system (NARS), a major reorganization was carried out in 1985. At present, the Ministry of Agriculture consists of five major departments (Chart 1, page 12). These include the Department of Agriculture (DOA), Department of Livestock Development and Animal Health (DLDAH), Department of Food and Agriculture Marketing Services (DFAMS), Central Food Research Laboratory, and the National Agricultural Research and Services Center (NARSC). A Research Coordination Committee (RCC) oversees all agricultural research activities.

The Research Coordination Committee and the National Agricultural Research and Services Center are new institutional structures that were created to help plan and manage agricultural research in addition to developing operational and long-term development plans for a unified agricultural research network. The functions and roles of these two new institutions are shown in Chart 2.

The creation of the Research Coordination Committee and the National Agricultural Research and Services Center have helped strengthen and streamline the national agricultural research system. The goals of the new institutions are to:

1) formulate a national agricultural research policy;

2) improve the planning of the research program by establishing research priorities;

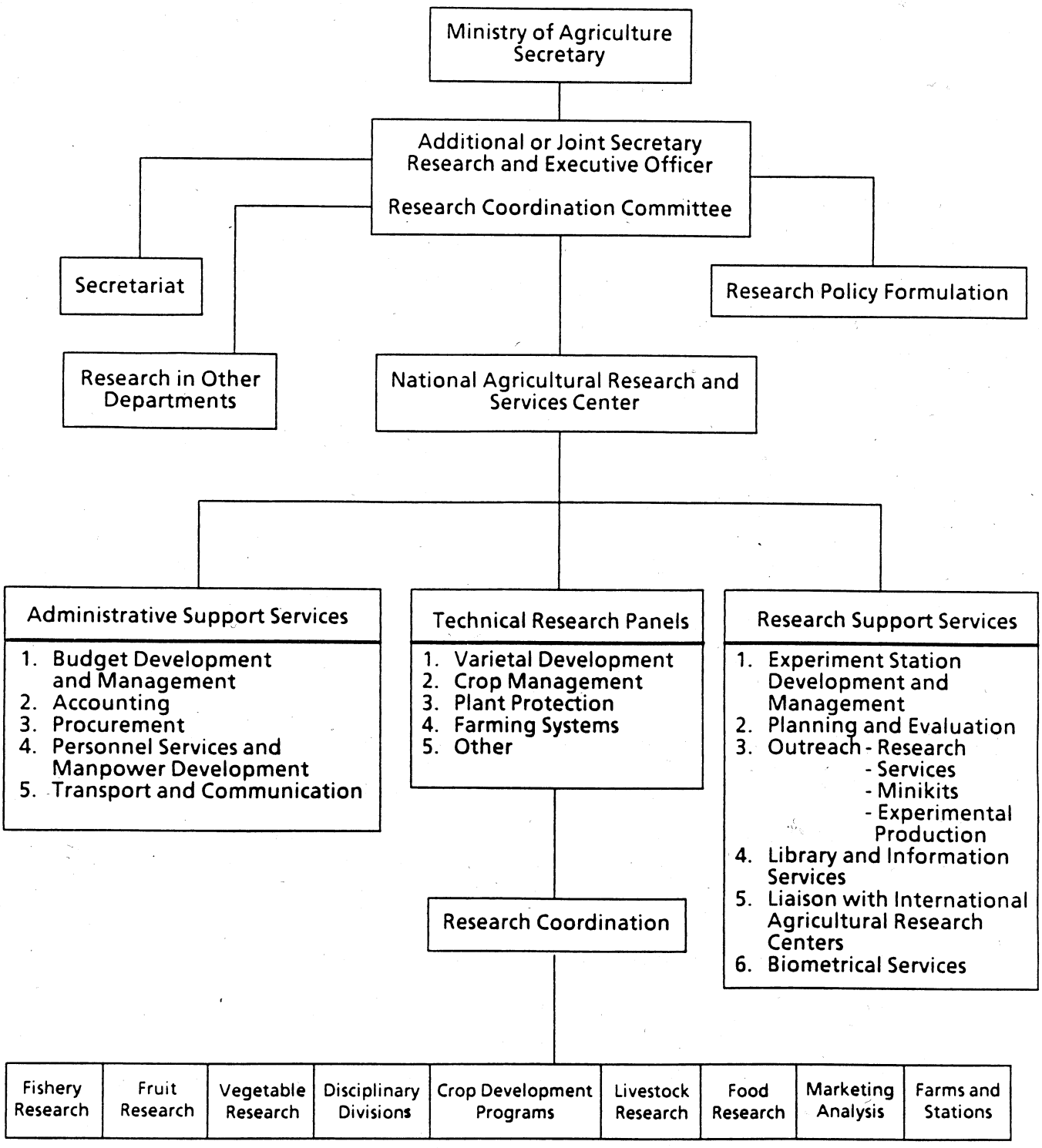
3) implement suitable changes within the administrative structure to provide flexibility

4) develop operational plans and institutionalize operational linkages with all concerned programs;

5) mobilize all available resources to achieve the goals of the NARS;

6) upgrade management skills, tools and techniques;

Chart 2: Functions and Roles of the Research Coordination Committee and National Agricultural Research and Services Center



7) upgrade the research reporting and evaluation systems to make research results more useful to extension workers and farmers so that agricultural productivity can be increased.

Research coordination. Prior to the establishment of the Research Coordination Committee and the National Agricultural Research and Services Center, agricultural research was scattered throughout the Ministry of Agriculture, with each of the major departments having their own research programs and activities. Coordination between the various programs was limited and competition for scarce research resources was high. Duplication of efforts between programs was also common.

Established at the ministerial level with a joint secretary for research (a newly created post) as the member-secretary, one of the major roles of the Research Coordination Committee is to coordinate all research activities within the Ministry of Agriculture and to establish linkages with research activities in other ministries and agencies as well as with the extension program. A second major role of the Research Coordination Committee is to develop an overall national agricultural research strategy by assessing the country's need for new technologies on a priority basis and to initiate their development, dissemination and adoption by Nepalese farmers.

The Research Coordination Committee is chaired by the Secretary of Agriculture, and members include the heads of the departments within the Ministry of Agriculture in addition to representatives from the National Planning Commission, the Royal Nepal Academy of Science and Technology, The Department of Resource Conservation, the Institutes of Agriculture and Animal Science and Forestry, as well as two progressive farmers and two research scientists.

Research program administration and support. In December 1985, the National Agricultural Research and Services Center was established within the Department of Agriculture to plan and execute all agricultural research programs according to the policies developed by the Research Coordination Committee. Two years after its implementation, it was separated from the Department of Agriculture and established as a separate organization with department status. The chief of the National Agricultural Research and Services Center now has full authority for planning and executing all agricultural research programs, which have now been relocated within the Center.

The National Agricultural Research and Services Center, with the support of the Research Coordination Committee, has the responsibility to carry out the development of appropriate technologies at the national level through the national commodity development programs as well as at the site level through the Farming Systems Research and Development Division and the outreach programs of the agricultural farms and stations.

The basic objective of the National Agricultural Research and Services Center is to coordinate agricultural research through the various phases from planning, execution, compilation and reporting of results to publication of results in appropriate forms for various users, not only scientists but extension personnel, farmers and administrators as well. The aim is to eliminate duplication, improve research facilities and their utilization, improve fiscal

and personnel management, develop research plans with short-term and long-term objectives, and improve overall research efficiency in the search for the appropriate technologies required for agricultural development in Nepal.

To carry out its objectives, the structure of the National Agricultural Research and Services Center brings different research agencies and programs together to implement a unified research program using a multidisciplinary approach. It has 18 disciplinary divisions, 10 national commodity programs and 31 agricultural stations and farms under its command. A standardized research protocol system has also been instituted in which all programs submit their research proposals for on-station and on-farm trials to technical committees within the National Agricultural Research and Services Center. These technical committees are comprised of senior scientists who review the proposed research activities to ensure that all research is in line with the priorities established by the Research Coordination Committee. There are also standardized formats for data analysis and reporting, as well as standardized equipment purchases to facilitate repair and maintenance. In addition, the Center has brought together individual research libraries into a central national research library and publishing center, but most important, it provides a center point for linkages with international agricultural research centers and foreign donors. This has helped to ensure balanced development within the entire agricultural research program.

The Center is structured to provide administrative, financial, research and technical support services to all the programs under its command. At present, it has the major responsibility for undertaking research on cereal crops (rice, wheat, maize and finger millet), pulses, oil seeds, horticulture, livestock and agricultural marketing research. The organizational structure is presented in Chart 3, and the primary functions and linkages of the individual programs are shown in Chart 4.

AGRICULTURAL RESEARCH POLICY

The national agricultural research program in Nepal has gone through some rather dramatic changes over the last two decades. These changes are the result of changes in the government agricultural research policy, which had been criticized for its poor performance in developing the technologies required to boost agricultural production. In the past, research efforts and resources were utilized disproportionately in terms of the needs of the farmers in the Hills and the Tarai. Irrigated conditions, which are predominently in the Tarai, have received more attention than rainfed conditions, which are common in the Hill and Mountain Regions. Likewise, farmers in the Tarai who have had greater access to resources (credit and inputs) have been favored over the more resource-poor farmers of the Hills and Mountains.

A number of factors responsible for this limited performance in agricultural research have been identified. These include:

1) the lack of a well-defined operational strategy for research;

Chart 3: Organizational Chart of The National Agricultural Research and Services Center

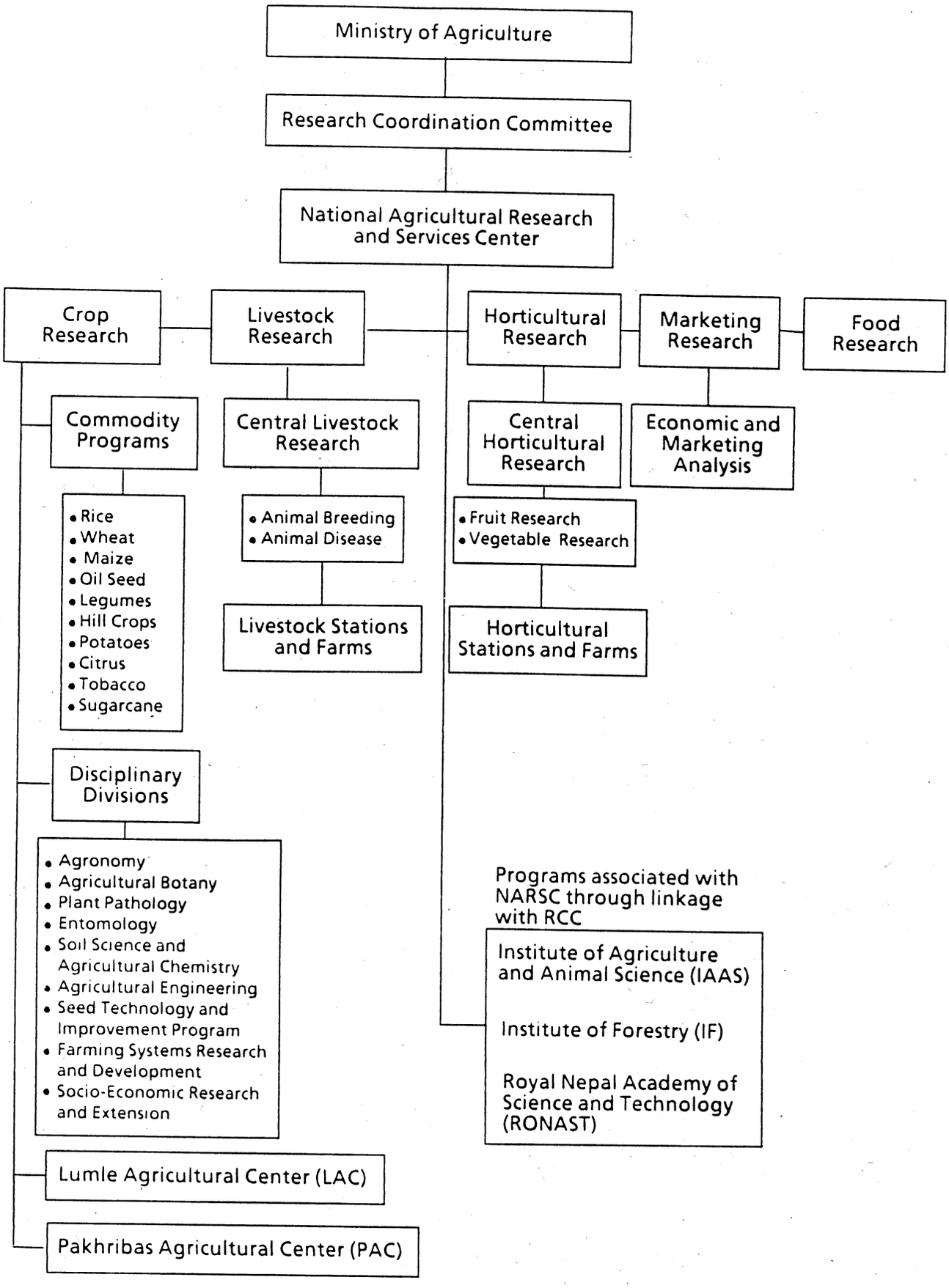


Chart 4: Primary Functions and Linkages of Organizations within the National Agricultural Research System

Organization	Primary Function	Linkage
RCC	a. Develops agricultural research strategy. Coordinates research activities with other agencies and ministries. b. Establishes research priorities for all research programs.	Joint secretary of Research, Ministry of Agriculture acts as Member-Secretary
NARSC	a. Plans, monitors and evaluates the research programs conducted by the crop commodity programs, disciplinary divisions, agricultural farms and stations. b. Coordinates research programs in major and minor cereal crops, pulses, oil seeds, livestock and pasture, horticultural crops and agricultural marketing.	Advised by the RCC under the MOA. RCC comprised of representatives from various disciplines including farmers and research staff. Technical committees review research proposals against research priorities developed by the RCC.
LAC	a. Implements extension and training programs in specific target areas in the western Hill region supported by an on-station and on-farm research program. b. Acts as a center for basic research, foundation seed production, fruit and forest tree multiplication, and production of exotic livestock. c. Serves and supports agricultural development in the western Hill districts.	a. Supported by the British ODA. b. Participates in the National Crop and FSR workshops c. Technically integrated under NARSC d. Works closely with other agricultural projects in the region
PAC	a. Implements extension and training programs in specific target areas in the eastern Hill region supported by an on-station and on-farm research program. b. Acts as a center for basic research, foundation seed production, fruit and forest tree multiplication, and production of exotic livestock. c. Serves and supports agricultural development in the eastern Hill districts.	a. Supported by the British ODA. b. Participates in the National Crop and FSR workshops c. Technically integrated under NARSC d. Works closely with other agricultural projects in the region
IAAS	a. Produces graduates in agriculture and animal science. b. Carries out research on crops, livestock, veterinary medicine, horticulture, social sciences, etc.	a. Advised and guided by Tribhuvan University, Ministry of Education. b. Linked to NARSC through RCC.
IF	a. Produces graduates in forestry. b. Carries out research in forestry.	a. Advised and guided by Tribhuvan University, Ministry of Education. b. Linked to NARSC through RCC.

2) inadequate facilities at research farms and stations;

3) poor feedback systems, limiting the flow of information between researchers and farmers;

4) unscientific monitoring and supervision of research programs and research staff;

5) financial procedures and management systems that are not responsive to the seasonal nature of research and often result in delayed release of required budgets during critical periods;

6) wasteful competition between research programs and prioritized production programs for scarce resources.

The recent reorganization within the Ministry of Agriculture was designed to address these problems. Although the Research Coordination Committee and the National Agricultural Research and Services Center have only begun to operate, solutions to many of these issues have already been instituted.

The present five-year plan (1985-1990) has emphasized the need to strengthen applied and adaptive research programs and to test new technologies in farmers' fields, especially in the rainfed and resource-poor Hill areas. Linkages with the IARCs are also to be strengthened to make the most efficient use of resources within the country and to derive the maximum benefit from knowledge and advancements made outside the country. The technology verification, packaging, and dissemination components of the agricultural farms and stations are also to be further developed to make the transfer of technology and technical services to the farmers in the command areas more rapid.

RESOURCES FOR AGRICULTURAL RESEARCH

Financial Resources

Expenditures on agriculture for the period 1970-71 to 1980-81 constituted approximately 42% of the total budget for the agricultural sector (which includes agriculture, forestry, irrigation, land reform and cadastral survey), or 12.5% in terms of the total development budget. Agricultural research expenditures accounted for 2.3% of the total development budget, or 19% of the budget allocation for the agriculture sector. Agricultural research expenditure as a share of the agricultural GDP has remained around 0.22% between 1970-71 and 1980-81. However, agricultural research expenditure as a share of total dvelopment expenditure declined from 2.76% in 1970-71 to 1.33% in 1980-81. Similarly, agricultural research expenditure as a share of the agriculture-sector budget has declined substantially from 13.6% in 1970-71 to 5.4% in 1980-81 (Yadav, 1987). Table 9 shows the average shares and annual growth rates for research expenditures for the period 1970-71 to 1980-81. Annual growth rates in budget expenditures for research have been below 4% (2.8% for crop research), compared to a 7% growth rate for agricultural extension. The annual growth rate for horticulture has been around 9% while that for livestock has been 3% (Yadav, 1987).

Table 9: Agriculture-Sector Budget Expenditures
(1970-71 to 1980-81)

	Annual Average Expenditure '000 Rupees	Percent of Agricultural Development Budget	Percent of Total Development Budget	Growth Rate (%)
Agricultural Research	17,575	19	2.3	3.92
Agricultural Extension	10,639	11	1.4	7.16
Other Agricultural Expenditures	65,114	70	8.8	14.35
Total Agriculture	93,328	100	12.5	10.95
Agriculture-Sector Total	222,127	42	29	13.56

Source: Yadav, 1986.

Table 10 shows the breakdown of expenditures within agricultural research. Crop research had the largest proportion (37%) while socio-economic and marketing research had the lowest (3%). Within crop research, cereal grain crops accounted for 80% of the total expenditures. Major funding sources for agricultural research include the government as well as other donor countries and agencies. Examples of these various funding arrangements include LAC and PAC which are wholly funded by the British Aid Program, and the National Agricultural Research and Services Center, Farming Systems Research and Development Division and Socio-Economic Research and Extension Division which are funded by a USAID project on a percentage basis but annually decreased over the life of the project.

Table 10: Agricultural Research Expenditures by Discipline
(1970-71 to 1980-81)

Category	Expenditures ('000 Rupees)	Share in Percent
1. Crop Research	6,457	37
2. Livestock Research	3,993	23
3. Horticulture Research	3,642	21
4. Fisheries Research	1,355	8
5. Input Research	796	4
6. Food Research	788	4
7. Socio-Economic and Marketing research	536	3
Total Research Expenditure	17,575	100

Source: Yadav, 1987.

Human Resources

Insufficient manpower is no longer a major constraint to better agricultural research in the country. Each year the number of professional agriculturalists is increasing. Professional staff working in the government are divided into two categories, gazetted and non-gazetted. Gazetted, or officer-level staff, usually have as a minimum a BSc in an agriculturally related field. They are further divided into I, II and III class levels. Non-gazetted, or assistant-level staff, have a high school certificate and two to three years of training in agriculture. They are also divided into First Class -- Junior Technician (JT) -- and Second Class -- Junior Technical Assistant (JTA) -- levels. Total manpower in agricultural research increased from 352 officers and 1,045 assistants in 1970, to 773 officers and 2,450 assistants in 1980 (Sharma, 1981). This has further increased to 1,173 officers and 4,350 assistants in 1984 (APROSC, 1986). In summary, between 1970 and 1984, the number of research officers increased more than threefold and the number of assistants almost fourfold. The educational qualifications of officer-level staff are given in Table 11 by discipline.

Table 11: Qualifications of Officer-Level Staff in Agriculture by Discipline - (1983-84)

Discipline	PhD	MSc	BSc	Total
Agricultural Engineering	-	15	43	58
Agricultural Extension	3	22	180	205
Plant Pathology	1	15	23	39
Horticulture	1	26	86	107
Agronomy	5	55	208	268
Fisheries	-	15	45	60
Entomology	2	16	12	30
Agricultural Economics	8	86	10	104
Agricultural Statistics	1	25	3	29
Soil Science	-	18	21	41
Botany	3	15	3	21
Food Technology	1	10	8	19
Veterinary and Animal Health	2	36	80	118
Dairy Science and Technology	-	18	43	61
Livestock	1	5	3	9
Total	28	377	768	1,173

Source: APROSC, 1986.

Though manpower shortages have not been a constraint, the proper management and utilization of manpower has been a major problem, especially in assigning the appropriate person to the appropriate post. In some programs, there are more personnel than are required while in other programs there are staff shortages and staffing has not matched the work loads of individual programs. For example,

there is a considerable shortage of staff in the newly created National Agricultural Research and Services Center Secretariat while in many of the disciplinary divisions there are more than enough surplus personnel who could staff the Center Secretariat. However, transfer of personnel from one program to another is a difficult and lengthy process. At present, the Farming Systems Research and Development Division and the Socio-Economic Research and Extension Division have not been able to fill all the positions which have been allotted to them. Some staff have been deputed from other locations while others have been assigned on a temporary basis. This method of staffing has hampered the effective operation of these new divisions, especially in their training programs in on-farm research.

The Institute of Agriculture and Animal Science has the responsibility for producing graduates with a BSc degree in general agriculture and in animal science. The institute is developing an MSc program in specialized agricultural and animal science subjects which it plans to implement in the near future. Presently, training opportunities for MSc and PhD degrees are provided by the Department of Agriculture and other donor agencies in educational institutions outside the country. In addition, the Department of Agriculture also provides opportunities for its professional and technical staff to attend short courses such as those at IRRI and CIMMYT. For junior technical staff, the Department of Agriculture has an "in-service" training program which allows them to pursue a BSc degree in agriculture or animal science. Positions are limited and individuals are selected on the basis of merit, educational qualifications and their service record.

Physical Resources

Research activities of the National Agricultural Research and Services Center are carried out at the government agricultural farms and stations under the various national commodity programs and research divisions. Agronomy farms conduct research and production activities on cereal and cash crops, horticultural farms on fruits and vegetables, and livestock farms on livestock, forage and pasture. Larger farms are designated as agricultural stations and include crop and/or horticulture and/or livestock research activities together, in addition to production and service functions. The national rice, wheat and maize commodity programs are the best established, having received major support from donor-funded projects.[5] Other research stations and programs (livestock, forestry and horticulture) have fairly good working facilities but have received less support from donor-funded projects. This has caused an imbalance in the development of the overall research system and has limited, to some extent, the government's ability to launch an effectively coordinated program on all fronts.

All government farms and stations perform their activities under the guidance of the National Agricultural Research and Services Center.

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5 These stations are all located in the Tarai. The commodity program for maize is located at Rampur, Wheat at Bhairawa, and Rice at Parwanipur.

Most farms and stations are equipped with administrative offices, staff housing, vehicles and other facilities. They are fairly independent and require only administrative and research support services from the National Agricultural Research and Services Center and other related institutes. The National Agricultural Research and Services Center as a services center, however, is highly centralized with regard to the major services it provides to its various research farms and stations. For example, all disciplinary divisions that provide advisory services (i.e., soil, seed, plant insects and diseases, etc.) are located in Kathmandu Valley. Because the demand for these services has increased substantially during the past few years, the availability of these services and facilities are limited to the outlying farms and stations. It is anticipated that once the National Agricultural Research and Services Center becomes fully operational it will have sorted out these emerging problems.

CONTRIBUTIONS OF RESEARCH TO AGRICULTURAL DEVELOPMENT

Since the late 1950s when agricultural research began growing in importance in Nepal, 29 new high-yielding varieties of rice, 10 of maize and 15 of wheat have been released. The adoption rate for high-yielding varieties of wheat is now greater than 95% and the area planted to these new wheat varieties has increased by almost 58% since 1975 (for the Hill Region the increase has been over 80%, see Table 6). For maize and rice, the adoption rates of high-yielding varieties are currently 35% and 25%, respectively (Yadav, 1987). National research programs are now engaged in their own breeding programs using many of the varieties that have been collected in Nepal. Both on-station and on-farm research is becoming more oriented to the problems of individual agro-ecological regions, and the growth of regional centers is a major part of the national agricultural research strategy.

Adaptive research efforts up to the present have primarily benefited the Tarai areas. However, the lack of new varieties for the Hill Region as well as for resource-poor conditions has led to a new emphasis on applied research to identify and solve problems within the complex Hill farming systems. Recently, a new commodity program dealing with important Hill crops has been established at a Hill research station. Work has started on developing low-input technologies for resource-poor farmers. Research staff are spending more time in the field trying to understand farmers' constraints and problems.

However, problems still remain. Low morale, postings in remote and isolated areas, limited linkages with the extension program and inadequate research funds are but a few of the major existing constraints.

CHAPTER THREE

ORGANIZATION AND MANAGEMENT OF ON-FARM RESEARCH

EVOLUTION OF ON-FARM RESEARCH IN NEPAL

Introduction

On-farm research takes place in a great number of institutions in Nepal. Many of the government as well as nongovernment research programs have various types of on-farm activities, and a large number of agricultural and rural development projects have on-farm research components.

On the whole, on-farm research in Nepal means on-farm trials. Different types of surveys, different ways of interacting with farmers and development agencies, different types of communication methods, and alternative ways of organizing and managing programs are frequently not thought of as "on-farm research" (Biggs and Rood, 1987). This conceptualization of on-farm research in Nepal may in part be due to the dominance of biological scientists in the research system and until recently the virtual nonexistence of social scientists. Biological scientists are just beginning to recognize the importance of social science research methodology and its role in agricultural research.

The concept of on-farm research being client oriented and problem solving in nature has taken time to evolve in Nepal. In a stepwise fashion, the concept of farmers as the clients of research has been continuously redefined. As more and more research staff learn about the heterogenity of conditions in Nepal and among farmer groups, on-farm client-oriented research, as a concept, grows in strength. With the recent shift in research emphasis by the government from the relatively homogenous conditions of the Tarai to the much more complex conditions of the Hills and Mountains, a more robust OFCOR[1] approach suitable for these more marginal areas needs to be developed. With the move to a broader, interdisciplinary, systems mandate and the increased recognition of the role of socio-economics, new problems are being uncovered both in the institutionalization and operation of these programs, and solutions need to be found.

Historical Development

On-farm client-oriented research (OFCOR) was first begun in Nepal in the mid-1950s after the introduction of Japonica rice varieties from

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1 For definition of on-farm client-oriented research see "Introduction to the ISNAR study on organization and Management of On-Farm Client-Oriented Research", pp iii.

Japan in 1954. Mr. N.B. Basnyat, then a government agronomist, evaluated these rice varieties at the government farm in Kathmandu and also in several farmers' fields in and around the Kathmandu Valley.[2] As a result of this on- and off-farm testing, these varieties were found to be widely acceptable to the range of environments found in the valley and were quickly adopted by farmers.

In 1966, Mr. Basnyat became the Director of the Department of Agricultural Education and Research and launched a coordinated rice, wheat and maize improvement program (1967-1972) in the Botany Division. During this period, a number of researchers from this program were sent to international agricultural research centers such as CIMMYT and IRRI for training and a number of international specialists visited Nepal.[3] Though there were a few district agricultural extension officers testing new rice varieties in farmers' fields, the concept of OFCOR and a multidisciplinary approach to research was just evolving.

Farmer field trials were formalized in 1973 after the establishment of the national commodity programs in 1972. The majority of these trials, being researcher managed, were conducted in the Tarai Region where most of the government's agricultural farms and stations had been established. Farmer field trials are considered as OFCOR in Nepal as they provide opportunities for commodity-based researchers to explore on-station results under much wider agro-ecological conditions. They also provide an opportunity for interaction among researchers, extension personnel, and farmers. However, the linkage between the commodity-based research staff, who design and develop the trials, and the farmers who participate in the program has not always been direct. As many of the trials are implemented by research staff at outlying agricultural farms and stations, the center-based commodity researchers are often dependent upon an accurate flow of information from the field.

In the initial phase, farmer field trials were conducted primarily in the Tarai Region under resource-rich conditions, e.g., farmers' fields that were irrigated and highly fertile. This was primarily in response to the nature of the technology that was coming into the country from international sources. As an example, many of the initial farmer field trials for rice tested early-maturing varieties which were only suitable for areas that could be double cropped and which had irrigation facilities.

Toward the end of the 1960s and on to the mid-1970s, several large agricultural projects were implemented in the country.[4] As part of

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2 The on-farm testing was an informal program and initiated through the local extension office.

3 Glen Anderson from CIMMYT visited Nepal several times and promoted a strong relationship with the CIMMYT program. Glen Johnson, from USAID, also influenced the development of relationships with a number of international programs. Contacts with outside programs were further strengthened by the increasing number of scientists being sent out for training.

4 These include the Food Grain Technology Project (USAID) in the Tarai areas and the Hill Food Development Project (UN/FAO) in the Middle hills of the country.

their programs, these projects began to conduct farmer field trials on various crops to evaluate their yield potential under different agro-ecological zones. Farmer field trials were also introduced in the target areas of the Lumle and Pakhribas Agricultural Centers using inputs obtained from the commodity programs.

As results from the growing number of farmer field trials conducted in the country were sent back to the national commodity programs for analysis, it was soon realized that there was a large yield gap between on-station and on-farm trials, especially in those environments which were different from the stations. This resulted in the need for researchers to identify the major constraints responsible for this gap by verifying the performance of improved varieties under farmers' conditions in different agro-ecological areas.

The implementation of the Cropping Systems Program in 1977 under the Integrated Cereals Project was the first program to bring natural and social scientists together into an interdisciplinary team. Under this program, many different types of on-farm trials and socio-economic surveys were conducted at five cropping system sites that represented different agro-ecological areas. Each of these trials and surveys was organized and managed for different purposes. For example, agronomic trials included cropping pattern trials, component technology trials, varietal trials, fertilizer trials, and farmer field trials. Later on, these trials were subjected to agronomic and economic evaluations to formulate recommendations. Different types of socio-economic surveys[5] were used to gather information for the design and testing of cropping patterns in farmer's fields with farmer participation.

The Cropping Systems Program had a very active documentation program for publishing and distributing their trial and survey results. These publications became very popular with other agencies and institutions because of their usefulness and relevance. The program's methodology for conducting trials and surveys was later used by many other research organizations and development projects in the country.[6]

OFCOR work being done by Cropping Systems Program research staff demonstrated that researchers should not always be based on government farms and stations, rather, they should spend more time working with farmers. One result of this was that in 1981, the Department of Agriculture issued a directive to all commodity program coordinators and research station managers that researchers should spend at least 40% of their time in "outreach" activities in farmer's fields. However, the division of the researchers' work and duties was not well specified and as a result, not all off-station

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5 CSP methodology included Key Informant surveys, baseline surveys and in-depth households surveys as well as longer-term farm monitoring studies.

6 Many projects within the country, including the Pakhribas Agricultural Center and the National Rice Improvement Program's Outreach Program, requested CSP socio-economists to provide training for their staff to conduct formal and informal surveys.

activities were OFCOR related. Off-station activities included researcher involvement in training extension staff, monitoring farmers, estimating crop yields, visiting farmer's fields, farmer fairs, etc.

In 1982, the Department of Agriculture, encouraged by the promising results of the work of the Cropping Systems Program, launched a cropping systems-based production program on 5,000 ha in the Tarai using technology derived from the Cropping Systems Program. This program was subsequently extended the following year to 17,000 ha, and by 1986 it covered 100,000 ha in 22 Tarai and 6 Hill districts. Expansion into a greater number of Hill districts has been, in part, limited by the lack of relevant technologies for Hill farming systems. The complexity of these Hill farming systems and the many resource-poor farmers coupled with the lack of infrastructure, difficulty in providing inputs and heterogeneity of land types has led to increased emphasis on the development of programs to solve these problems.

Part of this emphasis has been on the development of more robust forms of OFCOR to address the problems of farmers in the more marginal areas of the Hills and Mountains. In 1984, the Lumle Agricultural Center adopted a farming systems-based approach and developed an interdisciplinary technique, the "combined trek" to identify and prioritize farmers' problems at their research sites. In 1985, two new disciplinary divisions, the Farming Systems Research and Development Division (FSRDD) and the Social Economics Research and Extension Division (SERED), were created by the government, based on the experience of the Cropping Systems Program which had come to an end. These new divisions, along with the national research programs, were directed to concentrate on the complex research problems in the Hills using a farming systems approach supported by a strong socio-economic program. Both the national program and the Pakhribas Agricultural Center adopted the "combined trek" methodology developed by the Lumle Center to better understand and identify farmer problems in their research command areas. Under joint agreement by all programs, this methodology is now referred to as a Samuhik bhraman, which in English means to travel together. Table 12 provides a chronological summary of the evolution of OFCOR in Nepal.

One of the most important policy issues now being debated in Nepal concerns the best institutional structure for agricultural research. To some extent this is being characterized as commodity versus farming systems research (or other on-farm and village-level research and development programs) which, unfortunately, has avoided the issue of the need to have both programs. The critical policy issues are 1) how much of each, and 2) how to structure and manage the system so that the interactions and linkages between the different components of the system take place in a cost-effective way.

Past behavior of research programs and institutions in Nepal shows that some parts of the suggested, ideal on-farm/on-station approaches consistently fail to be implemented well. For example, the commodity program's farmer field trials have not been effective in bringing about significant changes in the research objectives of some of the commodity breeding programs. Neither have the on-station/off-station activities of the commodity programs been

Table 12: Evolution of OFCOR in Nepal

Year	Event
1950s	On-farm research initiated.
1951-1960	Disciplinary divisions along with agricultural farms and stations established.
1961-1968	New crop varieties introduced into Nepal from international sources and tested by disciplinary divisions and farms.
1969-1971	Coordinated crop-improvement program implemented, and on-farm research strengthened.
1972	National commodity development programs for wheat, maize and rice established.
1973	Farmer field trials formalized through national commodity programs.
1975	Major evaluation of agricultural research program and projects by Rockefeller team. Greater emphasis on OFCOR programs in different agro-ecological areas stressed.
1976	Agreement signed between the Government of Nepal and USAID to implement the Integrated Cereals Project.
1977	Implementation of the Cropping Systems Program under the Integrated Cereals Project. OFCOR conducted at five cropping systems sites in different agro-ecological regions.
1981	Recommendations from Cropping Systems Program used in pilot production program at cropping systems sites.
	Guidelines for pre-production verification trials (PPVTs) prepared by Cropping Systems Program
	Extension staff trained by Cropping Systems Program to implement PPVTs in other regions of the country.
	Outreach program initiated at government agricultural farms and stations.
1982/83	Pakhribas Agricultural Center (PAC) implements a cropping systems-based program with assistance and training from Cropping Systems Program.
	The Department of Agriculture launches a cropping systems-based production program in 5,000 ha.
1983/84	Production program expanded to cover 17,000 ha.
1984	LAC adopts an FSR approach and develops the "combined trek" as an interdisciplinary technique to understand the constraints and problems of farmers in their research sites.
1985	Upon termination of the Integrated Cereals Project's Cropping Systems Program, the Government of Nepal establishes the FSRDD and SERED within the Department of Agriculture. Focus of OFCOR is directed at the complex Hill farming systems.
	Cropping system sites in the Tarai are phased out while sites in the Hills adopt FSR approach, additional sites in the Hills opened.
	LAC's development of a new methodology to identify farmer problems and priorities for OFCOR; the "combined trek" is adopted by FSRDD and PAC.
1985/86	Production program extended to 100,000 ha in 22 Tarai and 6 Hill districts.
1986	FSRDD and SERED are separated from the Department of Agriculture and relocated under NARSC.

Source: No-Frills, 1987.

effective in highlighting the need for a greater share of agricultural research resources to be allocated to other technology areas.

Despite the large share of government- and donor- funded research resources being directed at the development of the rice, wheat and maize commodity programs, these programs have not lobbied for a strengthening of the livestock and forestry programs. The strengthening of these programs and their capacity for technology development might have greater longer-term payoffs for all research programs, even for the rice improvement program, than the current composition in the disbursement of research resources (Biggs and Rood, 1987). These points will come out more clearly in the following sections.

FOCUS ON CASE STUDIES OF FIVE OFCOR PROGRAMS

Case Study Programs

To analyze the evolution and different approaches taken to implement OFCOR in Nepal, five OFCOR programs have been chosen as case studies. The programs and the rationale for their selection are listed below:

Parwanipur Agricultural Station and the National Rice Improvement Program

As rice is the main food crop in the country, rice research is very important. Parwanipur Agricultural Station (PAS), being the center for the National Rice Improvement Program, has been emphasizing OFCOR in rice research to identify varieties suitable for the different agro-ecological areas in the country. The activities at Parwanipur are typical of the general approach used by all the national commodity programs.

The Cropping Systems Program

Initiated under the Integrated Cereals Project (1977-1985, funded by USAID) and attached to the Agronomy Division of the Department of Agriculture, the Cropping Systems Program had close links with the national commodity programs and the other disciplinary divisions of the Department of Agriculture. Using an interdisciplinary team of natural and social scientists, on-farm trials and surveys were conducted at six selected cropping system sites. During the implementation of the Cropping Systems Program, a number of important lessons about OFCOR organization and management were learned. These included the need to have center-based research staff actively involved in field programs as well as the need for strong linkages between the different disciplines and commodity programs. Many of these lessons have been incorporated into the present structure of the national agricultural research system.

The Farming Systems Research and Development Division

Upon termination of the Integrated Cereals Project, various ways and means of institutionalizing the work of the Cropping Systems Program were investigated by both the Government of Nepal and USAID. The establishment of the Farming Systems

Research and Development Division (FSRDD) along with the Socio-Economic Research and Extension Division (SERED) represents a major institutional change in the organization and management of OFCOR within the national agricultural research system. The FSRDD is now the leading government program responsible for conducting OFCOR.

The Lumle Agricultural Center and The Pakhribas Agricultural Center

The Lumle and Pakhribas Agricultural Centers (LAC and PAC, respectively) are regionally based autonomous research organizations located in the Hills. Both the centers are wholly funded by the British Government. Though their OFCOR work is limited to specific target areas and their methods of organizing and managing OFCOR differ from the approaches taken by the government programs, there have been important interactions between these programs and the national agricultural research system.

Complementary Nature of Case Study Programs

Each of the programs chosen for the case studies represents distinct organizational arrangements and management styles and has different objectives and mandates. They have always been perceived, however, as being complementary to each other. As will be seen in the analysis the following sections, individual programs have built upon the strengths and weaknesses of other programs not only in terms of program objectives but also in their having access to different resources, both financial and human. Some programs have been more successful in fulfilling their mandates but in no situation have the programs been viewed as competitive or individualistic. The degree of technical integration and sharing of ideas and methodologies between all programs has been very high.

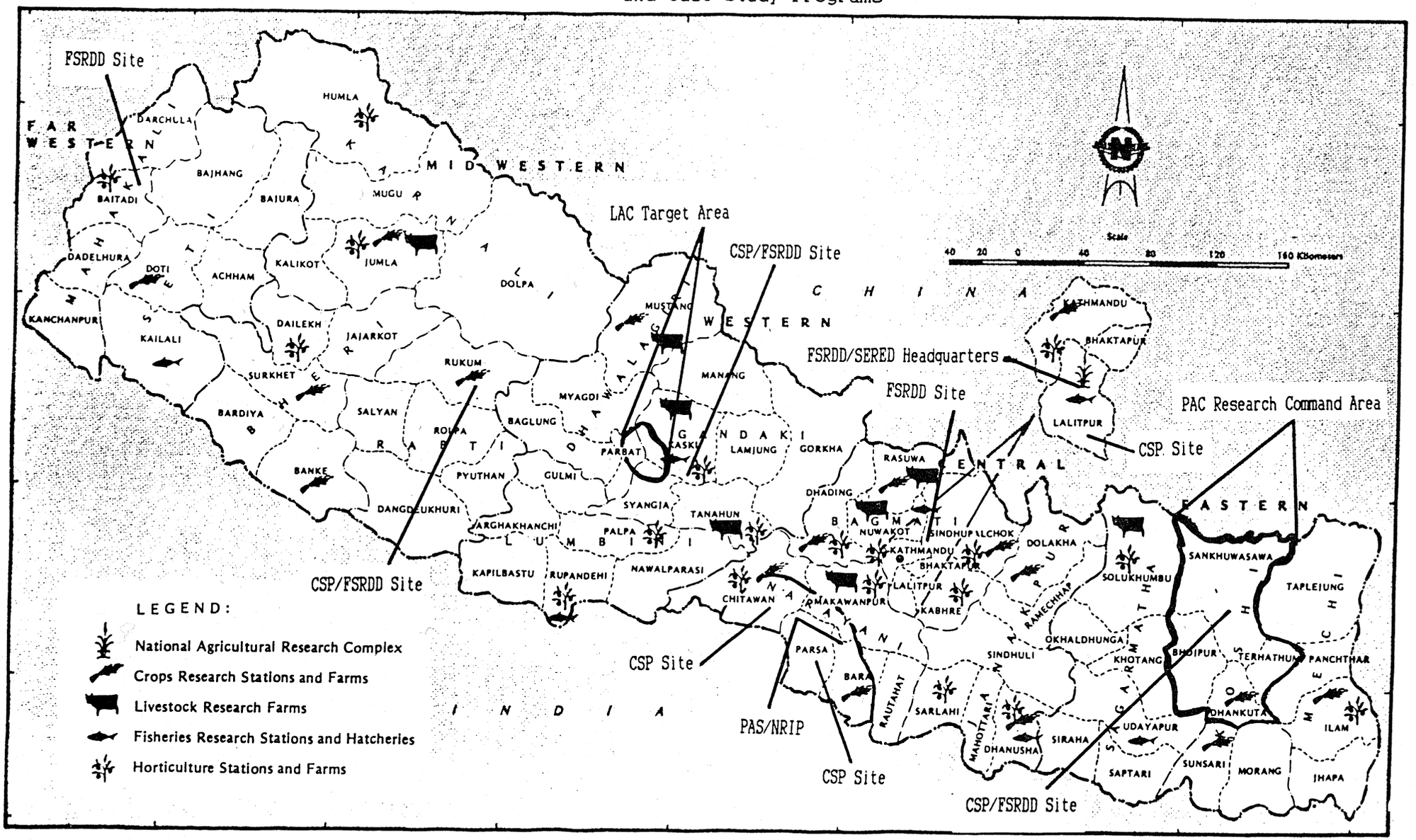
After the inception of the National Commodity Program in 1972, the Department of Agriculture organized annual national workshops for winter and summer crops. These workshops, which were a major part of the national agricultural research review and planning process, brought together many of the major participants in agricultural research programs, donors, ministry officials as well as extension workers, and representatives from input supply organizations. After the creation of the National Agricultural Research and Services Center, the crop workshops were replaced by a series of crop-, discipline- and program-specific working group meetings (i.e., Rice Working Group, Wheat Working Group, Farming Sytems Working Group, etc.) which are convened annually by the National Agricultural Research and Services Center. Although the membership has remained the same, the smaller size of the working groups (40 to 60 participants, compared to over 200 in the workshops) has allowed for more technical discussion and crop-specific planning. The development of recommendations for the extension service are a major part of the working group activities. All of the OFCOR case study programs have been active in these national-level workshops in the interchange of trial materials, trial ideas and methodologies. In addition, national level seminars have been held to discuss and standardize OFCOR trial methodology and data analysis techniques to ensure that results from individual programs can be better utilized by other programs.

Table 13: Summary of Basic Features of Case Study Programs

Activities	Program/Institutes PAS	CSP	FSRDD	LAC	PAC
1. Establisment	1949	1977	1985	1968	1973
2. Initial objectives	To improve the standard of rice-growing farmers through improved varieties and technologies for increased production and productivity	Increaase the productivity of the existing primarily nonmarket, subsistence agricultural systems used and practiced by most farmers in Nepal	To combine components of FS in an integrated way to lead real and sustainable increases in production.	Training ex-Gurkhas of the western Hills.	Training of ex-Gurkhas of the eastern Hills.
3. OFR introduced	1973	Early 1977	From the beginning	Mid-seventies	1975
4. Types of OFR: a) On-farm trials	Outreach research programs which include FFTs, cluster trials, production demonstration and minikit programs.	Cropping pattern trials varietal and fertilizer trials, FFTS and component technology trials.	Cropping pattern trials varietal and fertilizer trials, FFTs and component technology trials using a farming systems approach.	FFTs, minikits and varietal trials.	FFTs, diamond trials, minikits and cropping pattern trials.
b) Socio-economic	None	Key informant survey, baseline survey, household survey, narrowly focussed research area survey, and monitoring of labor and power requirement of farms.	Key informant survey, baseline survey, household survey, narrowly focussed research area survey, and monitoring of control and intervention farmers.	Site description survey, baseline survey and studies.	Site description survey, farmer survey and case studies.
5. On-farm research sites	Hill and Tarai districts.	Six cropping system sites: 4 in Tarai and 2 in Hills.	Five FSR sites, all in Hill areas.	Three FSR sites in Hill areas.	Twelve sites, all in Hill areas.
6. On-farm research staff	Mainly agronomists.	Agronomists, economists and extension staff.	Mainly agronomists but interaction with other disciplines.	Agronomist, livestock specialist, forester, horticulturist, economist and extension staff.	Agronomist, livestock specialist, forester, horticulturist, economist and extension staff.
7. Recent and new	None	Cropping systems-based production program implemented in 100,000 ha.	Conducts 'Samuhik Bhraman'.	Conducts 'combined trek'.	Conducts 'joint trek'.

Source: No-Frills, 1986.

Figure 2: Location of Agricultural Farms and Stations and Case Study Programs



Given the diversity in topography and regional socio-economic conditions, the complexity of farming systems and the numerous constraints to development in general, conducting on-farm, client-oriented research Nepal is a daunting task. It is hoped that the in-depth analysis of these five OFCOR programs will bring out important implications for research managers not only within Nepal but elsewhere. Table 13 provides a summary of the basic features of the case study programs. Figure 2 shows the locations of the case study programs within Nepal and also the locations of the major agricultural farms and stations.

PARWANIPUR AGRICULTURAL STATION AND THE NATIONAL RICE IMPROVEMENT PROGRAM

Historical Development and Objectives

Parwanipur Agricultural Station (PAS), located in the Tarai region (Figure 2), was established in 1949 as a government research station. Systematic research work however, was not undertaken until the mid-1960s. In 1972, the national commodity programs were established and were based on an interdisciplinary approach to maximize the production of a specific crop commodity. The National Rice Improvement Program has its headquarters at PAS. The objective of the Rice Improvement Program is to improve the standard of living of rice-growing farmers in Nepal through the introduction, development and testing of new rice-based technology for increased productivity. Since its establishment, many improved rice varieties have been identified, tested and released for general cultivation through a national varietal release committee.

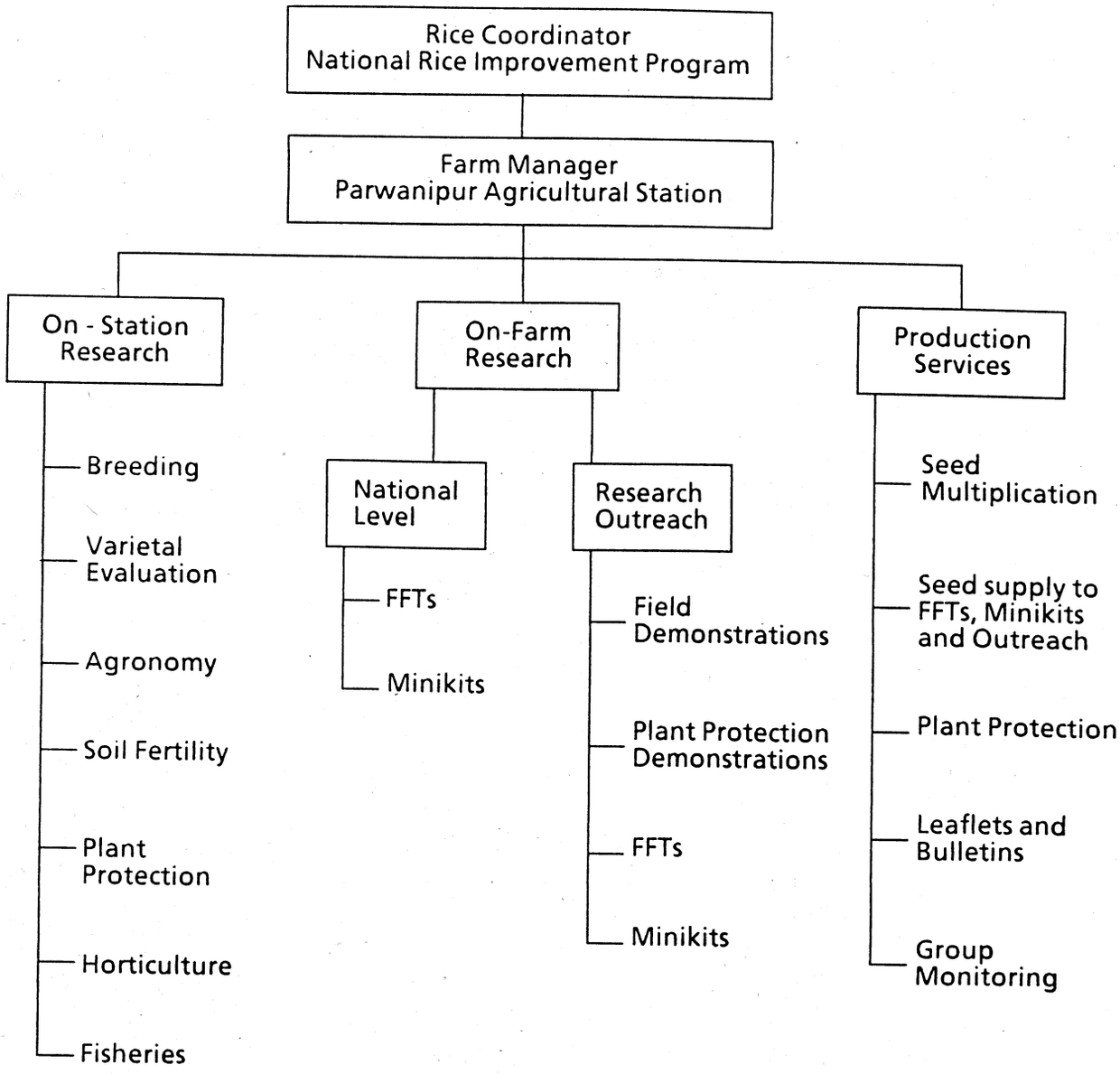
PAS uses a multidisciplinary team working together on-station to develop and test new varieties of rice and rice-based technologies. The team includes agronomists and plant breeders working together with a plant pathologist, entomologist, soil scientist and an irrigation and water management engineer. The team does not include a socio-economist.

The organizational chart for the Parwanipur Agricultural Station is shown in Chart 5. The rice coordinator and farm manager are responsible for rice research both on and off the station as well as for production services.

Internal Organization of OFCOR

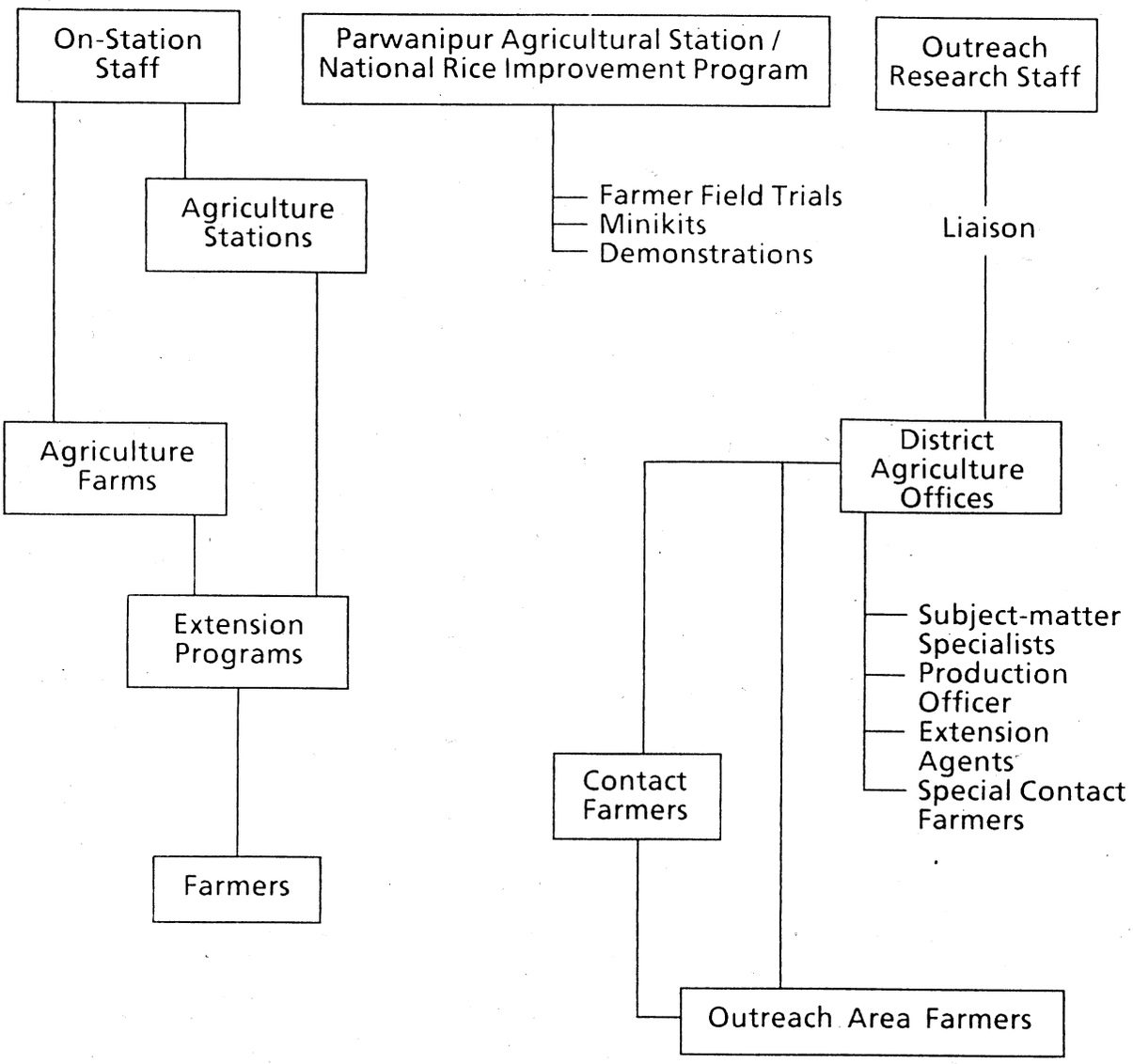
On-farm research at Parwanipur Agricultural Station follows two streams (Chart 6). The first involves the National Rice Improvement Program and focusses on the testing of new rice varieties and technologies at the national level and across several agro-ecological areas. Since its conception, the National Rice Improvement Program has been actively involved with the International Rice Research Institute (IRRI) in testing exotic rice varieties. Many of the staff have received long- and short-term training at IRRI in a wide variety of subjects, including breeding practices and testing methods. The second stream of OFCOR takes the form of a Research Outreach Program which was first implemented in 1983 within the neighboring districts around the Parwanipur Station. Research Outreach is a production-oriented service program

Chart 5: Parwanipur Agricultural Station Organization Chart



Source: No-Frills, 1986.

Chart 6: Organization of On-Farm Research within the Parwanipur Agricultural Station



which works to identify and solve farmers' constraints to increasing agricultural production through the use of applied and adaptive agricultural research. Similar programs are being implemented at all agricultural farms and stations under the guidance of the National Agricultural Research and Services Center.

Under this program, advice on appropriate technologies and farming practices is provided to farmers in the local command area on a regular and systematic basis through a close linkage with research and extension programs (Chart 6). At Parwanipur this program is funded by the World Bank and is organized along the lines of their research and extension projects. In Nepal this is called the Agricultural Research and Extension Project. The program incorporates training and visit (T&V) extension methods to make extension more effective by building stronger linkages and information flows among farmers, extension workers, and research programs.

The Agricultural Extension and Research Project has provided funds and training for three specially appointed research staff, based at the Parwanipur Agricultural Station, to liaise and coordinate OFCOR activities with the extension programs of the district agricultural offices in the command area. The Agricultural Extension and Research Project has also strengthened the extension staff within these district offices by providing each office with two discipline-oriented agricultural scientists who are called subject-matter specialists.

Development and Management of Human Resources

The two streams of OFCOR involve two distinct groups of staff. Research station staff involved in the farmer field trial and minikit programs are permanent government employees at the officer (gazetted) and technical (nongazetted) levels. The time commitment of these staff to OFCOR has been stipulated by the government such that they are to spend 40% of their time in OFCOR. Much of this commitment to OFCOR has been in the designing and planning of the varietal trials which are distributed to other government farms and stations for implementation and in analyzing the data that are sent back.

The research outreach staff have been hired on a temporary basis by the Department of Agriculture using funds provided by the Agricultural Extension and Research Project. Originally designed for a single Class II Officer, the post was downgraded to Class III because of the unavailability of qualified persons. Like research staff in the National Rice Improvement Program, the outreach staff are based at Parwanipur but spend the majority of their time working with the extension staff and subject-matter specialists in the command areas.

Profile of staff. Senior staff positions are shown in Table 14. Except for the temporary outreach staff, the commitment to OFCOR is only on a part-time basis. Though the government has stipulated that 40% of the research station's staff time should be allotted to OFCOR activities, no attempt is made to monitor this commitment. The amount of time spent in OFCOR activities is often dependent upon the individual interest of the research staff.

The research outreach staff, hired on a temporary basis through the Agricultural Extension and Research Project, have been mostly inexperienced university graduates. Their lack of experience in observing and dealing with agricultural problems in the field has limited their ability to develop problem-solving research proposals. Likewise, their lack of experience in handling crops, insects and diseases has not yet resulted in the degree of professional confidence that is required to effectively bridge the gap between a complex research station and field extension programs.

Table 14: Research Staff at the Parwanipur Agricultural Station

Subject	Total Research Staff		On-Farm Research Staff			
			Full-Time		Part-Time	
	Gazetted (G)	Nongazetted (NG)	(G)	(NG)	(G)	(NG)
Breeding	8	6	–	–	–	4
Agronomy	3	5	–	–	–	2
Plant Protection	4	4	–	–	–	–
Soil Fertility	2	3	–	–	–	–
Horticulture	1	2	–	–	–	–
Fisheries	1	2	–	–	–	–
Research Outreach	2	1	2	1	–	–
Total	21	23	2	1	0	6

Source: No-Frills, 1986.

Recruitment Mechanisms

Staff in the Outreach Program, unlike those in the Rice Improvement Program at Parwanipur, are hired directly for the purpose of carrying out OFCOR activities in the local command area. Staffing, however, has been on a temporary basis. The staff are appointed by the Department of Agriculture for six-month appointments and may be reappointed for additional six-month periods. Financial assistance is provided by the Agricultural Extension and Research Project to the Department of Agriculture to support these staff. Candidates are selected by the Department of Agriculture on the basis of their educational qualifications and their performance on a written test. They have little or no field experience, although in-service training in OFCOR has been provided by the Agricultural Extension and Research Project since temporary staff are not eligible to receive long-term training under current Department of Agriculture regulations.

Due to the temporary nature of the outreach staff, there have been major problems with staff continuity. Staff members have often left when they received permanent appointments elsewhere within the national agricultural research system. Differences in salaries and other benefits between government- and project-hired staff in

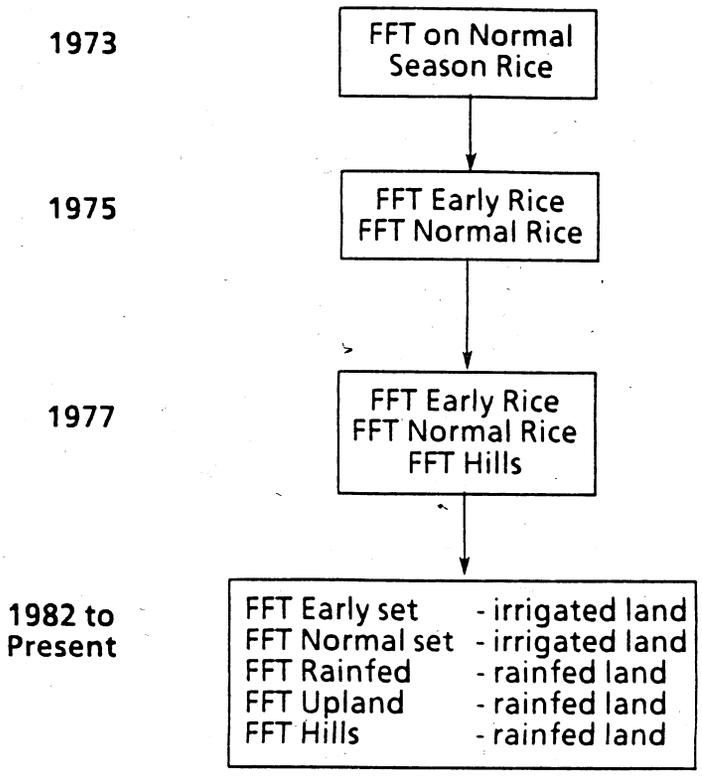
similar positions have often led to antagonistic relationships in the Rice Improvement Program at Parwanipur and in outreach programs. Outreach staff receive larger salaries and per diems in addition to better logistical support from the Agricultural Extension and Research Project than their colleagues in comparable positions. These temporary staff members, however, do not receive the standard benefits and allowances that are provided to permanent government employees.

Methodologies Adopted to Implement OFCOR.

National-level farmer field trials The Rice Improvement Program primarily uses researcher-managed farmer field trials. These are designed by the center-based National Rice Improvement Program staff to test new rice varieties against a local check variety. The trials are implemented in different agro-ecological regions by scientists at the outlying farms and stations in cooperation with extension staff from the local district agriculture offices. Extension staff stationed at these district offices select farmers for participation in the trials.

On-farm research trials have evolved over time to more adequately reflect the agro-physio-climatic conditions in Nepal (Chart 7).

Chart 7: Flow Chart of Modification of Farmer Field Trials (FFT) at the Parwanipur Agricultural Station



Source. No-Frills, 1986.

Rainfed, lowland conditions account for 60% of all rice land, irrigation (mostly wet-season irrigation) accounts for 30% and upland rice for 10%. Yet despite the predominance of rainfed conditions, there has always been a bias toward lowland irrigation, partly in response to government agricultural development policy and partly because of the nature of the exotic rice material being made available through the IARCs. This bias, however, is slowly being reduced, largely as the result of the initiation of the National Rice Improvement Program's own breeding program and the increased collaboration with other regional agricultural centers in the country. The increasing amount of feedback coming in to the Rice Improvement Program from the regional research scientists working together in farmers' fields within the different agro-ecological regions of the country has resulted in a change in the program's research priorities and the modification of its farmer field trial program.

Minikits. In addition to farmer field trials, minikits which are composed of small quantities of new rice varieties (released and pre-released varieties), planting instructions and farmer feedback cards are distributed, to farmers, at no cost through the national extension service across the country. Minikits have been designed to serve a dual research/extension function. At present, more emphasis has been given to the distribution of minikits in the Tarai and lower Hill areas where they have been used as a distribution tool for new rice varieties. If the varieties are acceptable to farmers the seed flows quickly into the farmer-to-farmer seed distribution network and thus the minikit becomes a very effective extension tool. In this way new rice varieties have been quickly extended to remote and isolated areas. Annually, the NRIP distributes approximately 20,000 minikits. As of 1985, 106,096 minikits (163 mt. of seed) have been distributed. Overall, more than 50% of the farmers receiving minikits showed a positive reaction toward the acceptance of the new varieties. However, the primary objective of the minikit, to get feedback from farmers, has been neglected as information from the minikits has not always been followed up or utilized by research staff.

Research outreach. The Research Outreach Program uses farmer field trials and minikits, along with component, fertilizer and cropping pattern trials. In addition, there is a greater emphasis on applied research. Special trials are developed at Parwanipur Station to investigate problems in the outreach command area which have been identified by district extension staff and/or outreach staff. Some examples of this are the trials developed to test for varieties resistant to rice gall midge, and direct seeding of rice.

Management of OFCOR

Management and supervision of field operations. Budgetary constraints which limit travel and payments for per diem expenses along with commitments to other station activities involving basic research have made it difficult for the National Rice Improvement Program staff based at the center to implement and supervise their own trials. Trials are sent to government farms and stations throughout the country for implementation. Extension staff in these areas select the farmers who participate in the trials.

Consequently, farmers have often been chosen to suit the needs of the extension staff who are responsible for implementing and managing the trials in coordination with outlying research station staff rather than according to the design of the trial itself. This has resulted from the lack of interaction between those who design the trials and those who are charged with implementing the trials in farmers' fields.

In the Research Outreach Program, farmers are also selected by extension staff but with assistance from the outreach staff. The outreach staff continually supervise outreach activities with the extension staff and report back to the on-station staff through a system of bi-monthly and semi-annual meetings. During these meetings, on-station research staff provide technical advice and guidance to the outreach staff.

Planning, programing and review mechanisms. For national-level evaluation, the Rice Improvement Program staff select rice varieties that have been screened and evaluated for several years at the station. As this material reaches the advanced trial stage, it is placed into farmer field trials to be tested at various locations throughout the country. These trials are designed and planned by the program staff and reviewed at the national crop working group meetings.

The Research Outreach Program uses both bi-monthly and semi-annual meetings to review and plan field activities. Bi-monthly meetings are held at the station and are attended by the district agricultural development officers, subject-matter specialists, research outreach staff and on-station staff. The objectives of these meetings are:

1) to review the agricultural situation in the field in the last two months;
2) to discuss the problems identified by extension workers, farmers and outreach research staff and to work out their solutions;
3) to establish closer working relationships between extension and research staff.

The three-day semi-annual meetings take the form of regional workshops and include the same members as the bi-monthly meetings. The objectives of the workshops are:

1) to review and discuss developments, program strategies and field problems from the previous cropping season;
2) to list and discuss field problems related to crops, extension activities and research priorities;
3) to identify and discuss important recommendations or extension activities for priority crops and research priorities for the next season within the framework of past experiences and field conditions;
4) to finalize recommendations on crops, extension activities and adaptive trials as well as the program strategy to be followed in the coming season (AERP, 1984).

Data analysis and dissemination of information. Data from the national-level trials are sent by the outlying farms and stations to Parwanipur for analysis. As there is no socio-economist at the station, OFCOR trials are evaluated only on agronomic criteria. From 1973 to 1977, farmer field trials were analyzed from a national perspective with the objective of identifying varieties that had wide adaptability across the country. Since 1978, less emphasis has been placed on the concept of wide adaptability and more emphasis has been given to the regional or area-specific performance of varieties. This change has allowed varieties that have performed well in only one region/area to continue to be developed specifically for that region. Results of the trials are reported to the stations which implemented the trials as well as at the national crop working group meetings. Summaries of the trial results along with the programs for the following year are published and distributed throughout the national agricultural research system.

Feedback from the minikit program has been less effective. There is confusion over the role of the minikit, especially with the extension staff who are responsible for the distribution of the minikits to farmers. Less emphasis has been placed on ensuring that the feedback card is filled in, collected and returned to the Rice Improvement Program. As a result, only a small percentage of the information cards have been returned for analysis, and this has reduced the effectiveness of the minikit as a research tool. Presentation of the minikit program at national working group meetings has tended to emphasize the program aspects (varietal content and national distribution) rather than an evaluation of the program's performance.

Data from the Research Outreach Program are collected by the extension staff in the districts with assistance from the outreach research staff based at Parwanipur. Agronomic analysis of the data is done at Parwanipur by staff in the National Rice Improvement Program, and the results are reported at the semi-annual meetings held at the station. These meetings include both outreach and on-station research staff and personnel from the district agricultural offices (subject-matter specialists, production officers and junior technicians). The results are also presented at the National Crop Working Group Meetings and published in their proceedings.

Organization and Management of Linkages and Information Flows

Within the national agricultural research system. The National Rice Improvement Program is directly linked to the national agricultural research system via the commodity programs and the disciplinary divisions. Staff from the Parwanipur Agricultural Station cooperate with other commodity programs in conducting on-station and on-farm trials as well as discipline-related trials.

Once a year, each of the crop commodity programs organizes a working group meeting through the National Agricultural Research and Services Center which researchers involved with that particular crop attend (the total number of participants varies between 30 and 60). This system has just recently replaced a system of annual summer and winter crop workshops. The Rice Working Group Meeting brings

together experiment station research staff from Parwanipur and OFCOR scientists from other farms and stations who have been working with rice improvement programs. These meetings provide a forum for particular research problems to be discussed with research staff from other programs and donor-funded projects as well as representatives from the National Agricultural Research and Service Center and personnel from the extension service. During these three-day meetings, trial results are presented and discussed, plans for new trials are developed and recommendations for new rice technologies are prepared for the extension programs.

Informal personal contacts are also an important means of transferring information between various programs.

Within and between on-farm research programs. On-farm client-oriented research in the National Rice Improvement Program is concerned with national- and regional-level evaluations, and it has maintained close contact with other on-farm research programs using its material and trials. Examples of this close linkage can be found in the relationships that have been established with the Lumle and Pakhribas Regional Agricultural Centers, the former Cropping Systems Program, and the Farming Systems Research and Development Division. Staff from the National Rice Improvement Program are invited to participate in the samuhik brhamans carried out by these institutions. However, participation in the Farming Systems Research and Development Division programs is poor due to the low per diem rates paid to government staff, which do not cover the costs incurred on trips to remote research sites. Recognizing this limitation, both Pakhribas and Lumle Agricultural Centers provide per diems for staff from the Rice Improvement Program per diem at their own rates which are much higher than those of the government. As a result they have better participation from the Rice Improvement Program staff in their samuhik bhramans.

Farmers and on-farm research staff. Much of the data from farmer field trials that has been fed back from the agricultural farms/stations has been unreliable, and the trials have often been too complicated to provide useful farmer feedback. This has primarily been the result of the lack of contact between the researchers and farmers participating in the farmer field trial and minikit programs. One advantage of the Research Outreach Program has been that it has helped to improve the supervision and feedback of the minikits and farmer field trials through the direct involvement of station-based OFCOR staff in the bi-monthly and semi-annual meetings. The research outreach staff, working in the local command area, have helped the Rice Improvement Program to develop better-designed trials at the national level and to get more relevant information from farmers.

Extension agents and on-farm research staff. In the farmer field trials, staff from the Parwanipur Agricultural Station seldom come into contact with the extension agents responsible for implementing the trials. This has led to difficulties in getting reliable data back from the trials and limits the amount of information that is available regarding the farmers who participate in them.

In the Research Outreach Program, because it is linked to the extension program through the trial and visit system, there is a good flow of information. Outreach staff meet regularly with extension staff, both in the field and in organized meetings at the research station.

Management of Financial Resources

Budgetary systems. Budgets for the Parwanipur Agricultural Station, National Rice Improvement Program, and Research Outreach Program follow the regular budgeting procedures of the Government of Nepal. Prior to the beginning of the fiscal year, the National Rice Improvement Program Coordinator and the Parwanipur Agricultural Station Farm Manager meet with the station staff to discuss the programs for the coming year. Decisions on programs are based on a number of factors which include the research priorities established by the Research Coordination Committee, the available manpower at the station and the physical resources available. One major disadvantage to this system is that problems identified during the year, for which investigative trials or research needs to be done, often have to wait for the next year's program. Funds once committed to specified trials cannot be changed to other programs.

Budgets for the planned activities are developed and passed to the National Agricultural Research Services Center for review and then forwarded to the Ministry of Finance for approval. Once approved, budgets are disbursed through a district-based government accounts controller office using a trimester allocation system. Delays are often experienced in the release of funds, which severely hampers

Table 15: Parwanipur Agricultural Station Budget for Fiscal Year 1986-87

Budget Heading	NRIP	PAS	Outreach	Horticulture	Fishery	Total	%
			(in '000 Rupees)				
Salary	100	700	70	140	110	1120	27.5
Seasonal Labor	100	100	25	30	40	295	7.0
Operation	200	320	100	90	100	810	20.0
Minikit	125	--	60	--	--	185	4.5
Machinery/ Equipment	30	50	40	10	30	160	4.0
Construction	--	--	1500	--	--	1500	37.0
Total	555	1170	1795	270	280	4070	
%	13.6	28.7	44.1	6.6	6.9		100.0

Source: No-Frills, 1986.

the on-going station activities. In addition, the present government budgeting system does not coincide with the main activities of the research program. This makes it difficult to carry out research activities (both in the field) and on-station which do not coincide with the fiscal year or which may be of a long-term nature.

In 1986-87, the outreach program at the Parwanipur Agricultural Station accounted for 44% of the station's total annual budget (Table 15). This figure is, however, inflated by the construction of housing and training facilities by the Agricultural Extension and Research Project. Staff salaries accounted for 27.5% of the total budget while operation and minikit budgets totaled 24.5%.

CROPPING SYSTEMS PROGRAM

Historical Development and Objectives

The establishment of the Cropping Systems Program in early 1977 represented two major changes in agricultural research policy. First, it was a commitment to increase the allocation of funds for adaptive research at the farm level, and second, it represented a change in research institutional policy, where previously, most on-farm testing and demonstration activities had been carried out by the main commodity and extension programs.

The Cropping Systems Research was initiated as a major component of the USAID-funded Integrated Cereals Project which was then working with the three major cereal crop commodity programs. It was attached to the Agronomy Division of the Department of Agriculture. The program, which was little more than a concept when it started, was strongly supported by the Chief of the Agronomy Division who had just returned from one year at the International Rice Research Institute where he had been working with IRRI's Multiple Cropping Program. The team leader of the Integrated Cereals Project had also participated in an international symposium on cropping systems at IRRI before arriving in Nepal.

The findings of the Rockefeller Foundation team's evaluation of agricultural research in Nepal, made it evident that to enable farmers, especially subsistence farmers, to use existing new technologies to increase their productivity would require more than what was being provided in the packages of practices developed from monoculture research in the national commodity research programs. The Cropping Systems Program was not designed as a substitute for the on-farm research activities of the commodity programs and disciplinary divisions. It was designed to be complementary to the existing on-farm research work by taking it one step further and examining the structural limitations within small farmer production systems, particularly those which could be advantageously modified or removed (ICP, 1985). Work on the major cereal crops was to be focused on their relationships to other crops and their relative importance within the systems used by farmers in different agro-ecological areas.

The Cropping Systems Program was designed to verify and adapt existing technologies from the crop commodity programs in the many

different farming systems and agro-physio-climatic conditions found in Nepal. This demanded a type of research that could only be done in farmers' fields. Six cropping system sites, representative of the major agro-climatic zones found in the Hill and Tarai areas, were selected for testing cropping system technologies. Each site was based on a small administrative unit within the district, called a village panchayat. (Each district is divided into 50 to 90 panchayats for administrative and voting purposes. On average, a panchayat contains approximately 600 households, population of 3700 and 800 ha of cultivated land.)

Recommended technologies and inputs for testing at the sites were obtained from the commodity programs and disciplinary units. Results from the cropping system site trials were then fed back to the commodity programs where they were extrapolated to other areas similar to the test sites. In the final stages of the Cropping Systems Program, successful technologies and cropping patterns that had been identified at the cropping system sites were used in a large-scale government-sponsored production program. By the end of the project, these technologies were being used in over 100,000 ha. The organization and technology verification process is shown in Chart 8.

Internal Organization of OFCOR

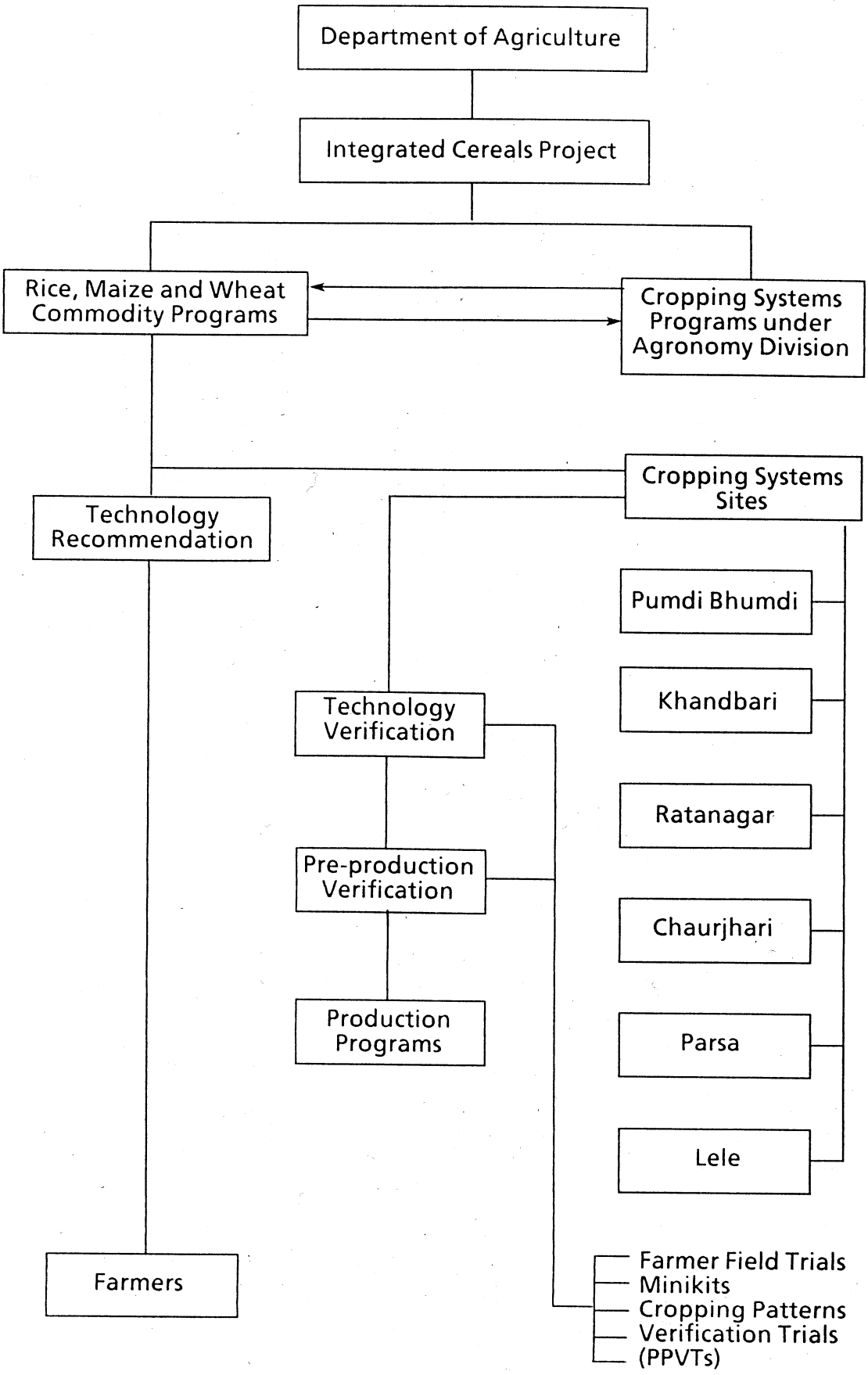
Table 16 shows the internal organization of the Cropping Systems Program for the center-based staff and the cropping system sites. The program operated with a center-based staff of agronomists and socio-economists located within the Agronomy Division, which has its headquarters in the Khumaltar Research Complex in Kathmandu. The staff in the Agronomy Division developed and designed the trials that were implemented by staff based at the cropping system sites.

Development and Management of Human Resources

Profile of staff. As the Cropping Systems Program was implemented as part of the Agronomy Division's regular program, two agronomists from the Division were assigned to work full time on Cropping Systems Program activities. The Head of the Agronomy division also acted as the Cropping Systems Program Coordinator. In addition to the agronomists, there was a socio-economic unit headed by a full-time socio-economist on deputation from the government. To support and strengthen the socio-economics unit at the center, a number of temporary staff were hired directly by the Integrated Cereals Project for the duration of the project. These temporary staff members included: one statistician, two supervisors, six enumerators, three statistical assistants and six other field staff.

In addition to the local staff at the center, two expatriate staff members, an agronomist and a socio-economist, were provided by the Integrated Cereals Project. The expatriate agronomist spent considerable time working with the staff in designing on-farm trials for the various cropping system sites, and developing new methodologies to conduct on-farm trials. His input into the Cropping Systems Program helped formulate a team of OFCOR-oriented research staff. At different times during the implementation of the

Chart 8: Cropping Systems Organization and Technology Verification Program



Source: Ho Frills, 1986

Table 16: Internal Staff Organization of Cropping Systems Program (1977-1981)

Research Teams	Team Members[1] Total	No.
Agronomy Division	16	
-Agronomists		2
-Extension Specialist		1
-Socio-Economist		1
-Statistician		1
-Supervisors[2]		2
-Enumerators		6
-Statistical Assistants		3
Cropping System Sites	41	
1. Lele	5	
-Site Coordinator		1
-Field Assistants[3]		3
-Socio-Economic Data Recorder		1
2. Pumdi Bhumdi	6	
-Site Coordinator		1
-Junior Technical Assistant		1
-Field Assistants		3
-Socio-Economic Data Recorder		1
3. Khandbari	6	
-Site Coordinator		1
-Junior Technical Assistant		1
-Field Assistants		3
-Socio-Economic Data Recorder		1
4. Chaurijahari	6	
-Site Coordinator		1
-Junior Technical Assistant		1
-Field Assistants		3
-Socio-Economic Data Recorder		1
5. Parsa (two sites)	12	
-Site Coordinators		2
-Junior Technical Assistants		2
-Field Assistants		6
-Socio-Economic Data Recorders		2
6. Ratanagar	6	
-Site Coordinator		1
-Junior Technical Assistant		1
-Field Assistants		3
-Socio-Economic Data Recorder		1
TOTAL	57	

Notes: 1- "Team members" includes government- and project-hired staff.
2- Supervisors were in charge of the enumerators, who were divided into two groups.
3- Field assistants were locally hired farmers.

Source: No-Frills, 1986.

program, an expatriate anthropologist and rural sociologist were also involved in the program for varying periods of time.

At the cropping systems sites, there were an average of five to six staff members. They included the site coordinator, one junior technical assistant, one socio-economic data recorder and three field assistants. Site staff were a combination of Department of Agriculture staff and individuals hired by the project. The site coordinators and junior technical assistants were either permanent Department of Agriculture employees assigned to work at the Cropping Systems Program sites or hired by the Department of Agriculture on a temporary basis for the life of the project. The majority of the field assistants and socio-economic data recorders were hired by the Integrated Cereals Project using project funds.

Recruitment mechanisms. Due to the project nature of the Cropping Systems Program, it was difficult to get Department of Agriculture staff assigned to cropping systems sites on a permanent basis. Permanent staff who were assigned by the Department of Agriculture were often transferred to other positions and programs within the department. Staff hired by the Department of Agriculture on a temporary basis to serve the Cropping Systems Program were continually seeking permanent employment opportunities and left as soon as they could get permanent positions within the government. Staffing of the sites was a continuous problem, which not only affected the continuity of the work at the sites but the training programs for staff in cropping systems research as well. To resolve many of these staffing problems, the Integrated Cereals Project hired individuals privately using project funds.

The lack of socio-economic faculty within the Department of Agriculture created difficulties in the staffing of the socio-economic unit within the Cropping Systems Program. The Integrated Cereals Project provided privately hired staff for the program, which at one time numbered more than 15 persons.

Methodologies Adopted to Implement OFCOR

The Cropping Systems Program in Nepal has been a leading member of the Asian Cropping Systems Network and has made extensive use of the cropping systems methodology developed at IRRI. Researchers at IRRI, notably Dr. Richard Harwood, were valuable sources of advisory assistance. The research methodology adopted depended upon the active participation of local farmers and research organizations. The major steps used to establish the field programs are outlined below.

Site selection. Cropping system sites were selected in six districts, two of which were in the Tarai and four were in the mid-Hills Region. Within each district, one village panchayat which offered a high degree of heterogeneity in terms of altitude, aspect, cropping patterns and ethnic group composition was chosen. The selected panchayats were those that were identified as having a high potential for crop intensification and which were representative of the major agro-climatic regions within the area. A key concept in

site selection was that the results from the program should be extrapolated to larger areas with similar conditions. Agronomists were mainly involved in selecting the panchayats. All selected sites had to be accessible by road or year-round commercial flights so that the center staff, based in Kathmandu, could supervise and monitor site activities as well as provide technical inputs from the center and from the commodity programs.

Site description. Once the panchayats had been selected, the Cropping Systems Program socio-economic unit conducted various surveys to describe the existing cropping situation and to develop alternative possibilities for each site. Key informant surveys, carried out by a team of enumerators from the Cropping Systems Program central office in Kathmandu, were used to quickly gather large amounts of agronomic and socio-economic data from the sites. The surveys were used to learn from farmers about farmers and their situations so as to have a more problem-oriented research effort on the part of the cropping systems team as well as the backup research effort of the commodity programs and discipline divisions (ICP, 1985). Within each of the selected panchayats, the survey team spent approximately one week interviewing knowledgeable farmers, political leaders and representatives from the institutions in the panchayat (Agricultural Development Bank, cooperatives, Agricultural Inputs Corporation). Using these surveys as a base, further household surveys were used to provide additional details on cropping patterns and livestock practices.

Design of cropping patterns. Once the common cropping patterns were identified, Cropping Systems Program staff developed alternative patterns, which would be more productive, for testing. The design of these alternative patterns was based on the potential of the site, the availability of appropriate technology, institutional constraints within the area, and the physical and socio-economic characteristics of the local farmers.

Testing of cropping patterns. Cropping pattern trials and management trials were tested in farmers fields at all sites. The participating farmers implemented the trials with frequent advice and monitoring from the site staff.

Adaptive research and pre-production testing. Results from Cropping Systems Program trials were analyzed over a three-year period using agronomic and socio-economic criteria before final recommendations were made to farmers at the sites. These recommended cropping patterns and practices were then further verified in other areas both within and outside the cropping systems site through the use of pre-production verification trials. This trial methodology allowed farmers to use the recommended practices on two-thirds of a test plot and their own regular practices on the remaining third.

The Cropping Systems Program-based production program. Once the new technology had been verified using the pre-production verification trials, small-scale pre-production programs were launched in both the Tarai and Hill Regions to demonstrate the performance of the new technology. Results of several of the recommended cropping patterns as compared to farmer's own practices are presented in Table 17. The final stage was the large-scale implementation of production programs.

Table 17: Pattern Yields in Pre-Production Blocks and Increases over Farmer Practices

Location	Year	Pattern*	Pattern Yield (t/ha)	Increase over FP %	% RAVC**
Parsa:					
Irrigated Lowland	1982/83	R-W-F	6.4	64	60
Rainfed Lowland	1982/83	R-W-F	4.6	142	110
Chitwan:					
Irrigated Lowland	1982/83	R-W-F	7.5	21	20
Lele:					
Irrigated Lowland	1982/83	R-W-F	7.2	36	40
Chaurijhari:					
Irrigated Lowland	1982/83	R-W+Mus	9.2	80	66
Irrigated Upland	1982/83	R+M-W+Mus	7.6	46	37

Notes: * R-W-F = Rice-Wheat-Fallow
R-W+Mus = Rice-Wheat+Mustard
R+M-W+Mus = Upland Rice+Maize-Wheat+Mustard
** Returns Above Variable Costs

Source: ICP, 1985.

Management of OFCOR

Management and supervision of field operations. Each cropping systems site had a staff consisting of one site coordinator (BSc in agriculture), one junior technical assistant and three field assistants. Field assistants were locally hired farmers and were trained by staff from the Cropping Systems Program center. The site coordinator was responsible for all site activities and was based at the site in a field office provided by the program. The field office provided a base for both formal and informal meetings with the local participating farmers. The junior technical assistant and field assistants collected and recorded all field trial data that were reported to the site coordinator. The site coordinators reported to the Head of the Agronomy Division in Kathmandu who acted as the Cropping Systems Program coordinator.

The Head of the Agronomy Division was responsible for coordinating and supervising the agronomic and socio-economic activities for all sites in addition to the supply of all inputs required by the sites.

Planning, programing and review mechanisms. The planning and programing of the Cropping Systems OFCOR activities was the responsibility of the Cropping Systems Program coordinator,

agronomists and socio-economists located within the Agronomy Division. As the Cropping Systems Program was part of the Agronomy Division, all OFCOR plans had to be prepared on an annual basis for inclusion in the division's yearly plan, which was submitted to the Department of Agriculture for approval and funding at the beginning of each fiscal year. Once the plans were finalized by the center staff they were sent to the site coordinators for implementation. Site coordinators were not involved in planning or in the design of trials on a regular basis.

Trials at each of the sites were monitored by the center agronomists during regular monthly visits. At the end of each cropping season, a review of the OFCOR activities was held by the center staff in association with the expatriate advisors.

Management of farmer collaboration. The selection of farmers to participate in trials was done at the site by the site coordinators. Farmers were selected using the following criteria:

1) They should be representative of the farmers within the community around the cropping systems site in terms of their risk-bearing capacity, physical resources and socio-economic background.

2) They should have sufficient and suitable land to implement the trial.

3) They should be willing to test alternative cropping patterns over an entire cropping season and actively participate in the management of the trial.

Data analysis and dissemination of information. Data recorded from the various cropping system sites were sent to the Agronomy Division by the site coordinators. Cropping Systems Program agronomists and socio-economists analyzed the data and together prepared the reports. These reports were provided to the sites and also presented at the national winter and summer crop workshops (which have since evolved into the national working group meetings). Many of the findings of the Cropping Systems Program were published and presented outside Nepal, especially in the Asian Cropping System Network meetings.

Organization and Management of Linkages and Information Flows

Within the national agricultural research system. Working directly with the commodity programs in testing existing and new technology at the cropping systems sites provided Cropping Systems Program staff with a strong linkage to research programs in the national agricultural research system. Their involvement in the summer and winter crop workshops also brought cropping systems staff and experiment station research staff together on a regular basis. During these workshops, results from the on-station and on-farm research programs were presented and jointly discussed. In addition, all inputs for the cropping pattern trials at the cropping systems sites were provided by the national commodity programs and other agencies, along with technical advice.

The role of the expatriates working within the Cropping Systems Program also helped establish good working relationships with the

national agricultural research system, especially in the commodity programs because other expatriates from the Integrated Cereals Project were assigned to the wheat, maize and rice commodity programs during the life of the project. These expatriates, who were assigned local counterparts within these commodity programs, facilitated communication between the Cropping Systems Program and the commodity programs' on-going research activities. This helped to further reinforce the development of linkages between programs. The Integrated Cereals Project, encouraged and provided logistical support for research scientists from the commodity programs and disciplinary divisions to visit and actively participate in the research trials at the cropping system sites.

Cropping Systems Program staff referred problems identified in the cropping system sites to the appropriate commodity program and/or disciplinary division for investigation. One example of this collaboration was the joint work of the National Maize Development Program and the Cropping Systems Program in the development of a short-duration maize variety (Arun) which was released in 1981. As a result of diagnostic work involving surveys and listening to farmers, Cropping Systems Program staff and breeders at the National Maize Development Program identified a gap in an existing cropping pattern (rice/wheat/fallow) within which a short-duration, spring maize crop could be grown in the Tarai and mid-Hills. The maize program quickly responded and developed the short-maturing (80-90 days) composite variety Arun. This efficient response from the maize program was a direct result of the close link between the Cropping Systems Program and the maize program staff, especially the maize coordinator, who was actively involved in the planning and selection of varieties for the cropping systems sites. Interaction between the two programs was further enhanced by the presence of an experienced expatriate maize agronomist who was working with the Integrated Cereals Project and the Cropping Systems Program.

Continued joint survey and testing work by other programs has led to the further development of successive generations of this maize variety which has become one of the most popular improved maize varieties in Nepal, not for its yield (which is lower than main-season varieties) but for its earliness. This maize variety was also tested at Pakhribas Agricultural Center. Although the farmers liked the early maturity of the variety, they were particularly fond of white seeded maize varieties. So, the National Maize Development Program quickly developed a white-seeded Arun variety which is now growing in popularity in the region around the Pakhribas. Likewise, at Lumle Agricultural Center, researchers found that the Arun variety was preferred over the regular main-season improved maize variety which gave a much higher yield. Farmers in this area who planted maize on their rice land found that the main-season variety had a very deep root system which made land preparation difficult for the following rice crop. The new Arun variety, which is earlier maturing and has a shallower root system, makes it easier for them to prepare their fields for the following rice crop.

However, despite several success stories, many of the linkages that did develop with the commodity programs tended to be one-way, from the commodity centers to the Cropping Systems Program. The Cropping Systems Program was viewed by many research staff in the commodity

programs primarily or exclusively as a mechanism to get research results "off the shelf" and out to farmers (ICP, 1983). Although the Cropping Systems Program contributed significantly to the researcher's appreciation of cropping patterns or sequences, this appeared to have had only a limited impact on research priorities. Despite the success of the Arun maize variety, the maize program continues to work primarily with main-season maize varieties with early screening for high yield. In another case, the Cropping Systems Program suggested that some of the fertilizer recommendations developed by the commodity and disciplinary divisions should be changed and this was not universally well received (ICP, 1983). The lower fertilizer recommendations were a result of studies on the avaiability of chemical fertilizers at the cropping system sites and the ability of the farmers to purchase these inputs. As in other countries and international centers, cropping systems research in Nepal has often been in an adversarial relationship with the commodity programs, especially over issues regarding the appropriateness of a particular variety or of varietal improvement strategies which tend to emphasize resource-rich conditions.

Within and between OFCOR programs. The Cropping Systems Program was very active in promoting the cropping system methodology in other projects and institutions working in Nepal. Publication of their various survey and trial methodologies and especially their pre-production verification trial guidelines were used in many other donor-funded projects. Cropping Systems Program staff were often called upon by other on-farm research programs to provide training in cropping system research methodology, especially survey techniques and trial methodology. The on-farm research staff from both the Lumle and Pakhribas Agricultural Centers participated in these training programs. In addition, many of the government agricultural stations/farms adopted the cropping systems methodology for implementing their outreach programs.

Farmers and on-farm research staff. Close links with the farmers involved in the OFCOR program were maintained in a number of ways. Especially beneficial was the establishment of the cropping system site office near the farmers who were participating in the trials. This allowed the farmers to attend meetings held at the site office and encouraged many farmers to make informal visits, often to discuss particular problems they were encountering. A second method of maintaining good links was the long-term relationship that builds up when cropping pattern trials are conducted with individual farmers.

Field days and farm tours were organized within the cropping system sites, giving participating trial farmers the opportunity to present their impressions of the trials to other farmers within the community. Site staff often found this interchange between participating and nonparticipating farmers useful in understanding the priorities of the local farmers and the types of new technologies that they were looking for. Tours were also organized for participating farmers to other cropping system sites where farmers from different areas could exchange ideas.

Attention to research-minded farmers who were implementing informal research in their own fields was not considered by the Cropping

Systems Program despite several instances where proposed practices and patterns had already been tried by farmers. In a survey conducted for this study, 48 farmers from two of the former cropping system sites were interviewed. Of these farmers, only 28% felt that the purpose of Cropping Systems Program staff at the sites was to identify farmers' constraints and to recommend new technologies; 44% felt that the primary purpose of the staff was to demonstrate new techniques to increase production. The remaining farmers felt the objective of the Cropping Systems Program was to teach new farming methods (16%) or to identify suitable varieties for particular agro-ecological climates (24%) (No-Frills, 1986a).

Extension agents and on-farm research staff. Effective linkages with the extension program were not developed until the pre-production and production stages. Because research staff managed the cropping system sites, local extension staff were not involved in the design, testing or recommendation processes. However, during the latter stages of the program, the government used the technologies developed and recommended by the Cropping Systems Program to launch small-scale pre-production testing programs and then, later, full-scale production programs which were managed by the extension service staff. Before implementing these programs, a series of pre-production verification trials, designed by the Cropping Systems Program, were carried out by government extension staff to verify the new technology's appropriateness for different areas. The Cropping Systems Program produced and developed a set of guidelines for implementing the trials. They also provided training to extension staff responsible for carrying out the trials. Only at this later stage in the Cropping Systems Program did stronger links begin to be developed with extension staff who were implementing the pre-verification programs in many parts of the country.

Management of Financial Resources

Budgetary systems. Funds for the Cropping Systems Program were allocated through the normal government budgeting procedures. Cropping Systems Program activities were included as a line item in the Agronomy Division budget. Much of the funding came from the Integrated Cereals Project indirectly by being channeled through the government's regular budget. Exact figures on budget allocations for the Cropping Systems Program are not available, but it is estimated that approximately 10% of the total budget for the Integrated Cereals Project of U.S. $16 million was directly spent on the OFCOR activities of the Cropping Systems Program during the project period from 1977-1985.

In the initial stages, the Cropping Systems Program was severely constrained by the late disbursement of government funds. This caused delays in the implementation of many trials and other OFCOR activities. The Integrated Cereals Project helped to resolve the recurrent problem of late budget disbursements by establishing a revolving fund for use by the Cropping Systems Program. Funds could be drawn from the revolving budget to ensure continuity within the program and could then be replaced when the normal Agronomy Division's trimester disbursements were received.

FARMING SYSTEMS RESEARCH AND DEVELOPMENT DIVISION

Historical Development and Objectives

After eight years of implementation, the Integrated Cereals Project and its Cropping Systems Program came to a scheduled close in 1985. Both the government and USAID were interested in institutionalizing the Cropping Systems Program to ensure a continuation of the program. Although there were critics of the Cropping Systems Program, it was generally accepted that the methods that had been developed for on-farm adaptive research were beneficial in increasing agricultural production. The program's links with other projects and regional programs involved in OFCOR activities had led to wide dissemination of methods and the creation of an extensive cropping system network within the country. This had outgrown the program's management ability and research staff working within the program had also realized that an approach limited to focussing on cropping systems was not the ideal one for trying to solve farmer's problems, especially those of the farmers living in the Hill Region.

The majority of the benefits from the Cropping Systems Program and the Integrated Cereals Project's assistance to the commodity programs were centered in the Tarai. The Cropping Systems Program successfully tested new technologies, particularly for wheat and maize, which were suitable for Hill areas, but much of the readily available component technology was applicable to the better endowed areas in terms of soil conditions, water availability and input delivery systems which were more characteristic of the Tarai than the Hills. There was a growing realization that the production systems of the farmers, especially resource-poor farmers, involved a high degree of interaction among crops, livestock, and forest resources. Crop intensification in some areas resulted in labor problems for taking care of livestock and the substitution of new varieties in existing cropping patterns resulted in less fodder for livestock. It was recognized that improvements to the overall farming system, especially for small farmers in the Hills, would necessitate the study of these interactions.

Research work being done at the Lumle Agricultural Center on improved varieties of millet highlighted these interactions and led to the implementation of a broader farming systems approach, which in turn influenced the national program. Lumle scientists found that farmers were quickly adopting a newly introduced variety of millet (NE 6401-26) despite the fact that it yielded more than 10% less than the local variety (Okhale-1). Farmers had found that the fodder quality of the new millet variety was far superior to the local, as it remained "green" up to harvest time. After harvesting, the green millet stems could be used for cattle feed. This was particularly important as the farmers at this time were busy harvesting and threshing rice and did not have time to cut fodder from the forests for their livestock. Similarly at the Pakhribas Agricultural Center, research scientists found that trials using a newly introduced exotic rice variety (Kaoshing-27) gave yields significantly greater than the common local rice variety (Pokhareli Masino). However, farmers were not interested in adopting the new rice variety. In discussions with the farmers, the researchers found that the amount of straw produced by the new variety was much less than the local rice variety. As rice straw is one of the major

sources of livestock feed, the quantity of straw was of critical importance to the farmers. This information has been used by Pakhribas to alter their varietal selection process and to introduce earlier screening for straw quantity.

During this same period, the government was preparing the five-year development plan for the period 1985 to 1990. In reviewing the progress that had been made under the previous plan, it was evident that the Hill Region was falling behind in food production, with many areas experiencing food shortages. Emphasis in the new five-year plan placed the development and testing of appropriate technology for the Hill Region at a high priority level. Agricultural research policy was changed to focus increased attention on the problems of the Hill farmers using a farming systems approach.

In response to this need, the government institutionalized Cropping Systems Program activities into two new disciplinary divisions: the Farming Systems Research and Development Division (FSRDD) and the Socio-Economic Research and Extension Division (SERED). The rationale for this was based partly on the need to give the work of the Cropping Systems Program the necessary status within the NARS:

1) to avoid the suggestion of disciplinary bias as it moved into a farming system research mode;

2) to improve its ability to attract and retain staff from a variety of disciplines;

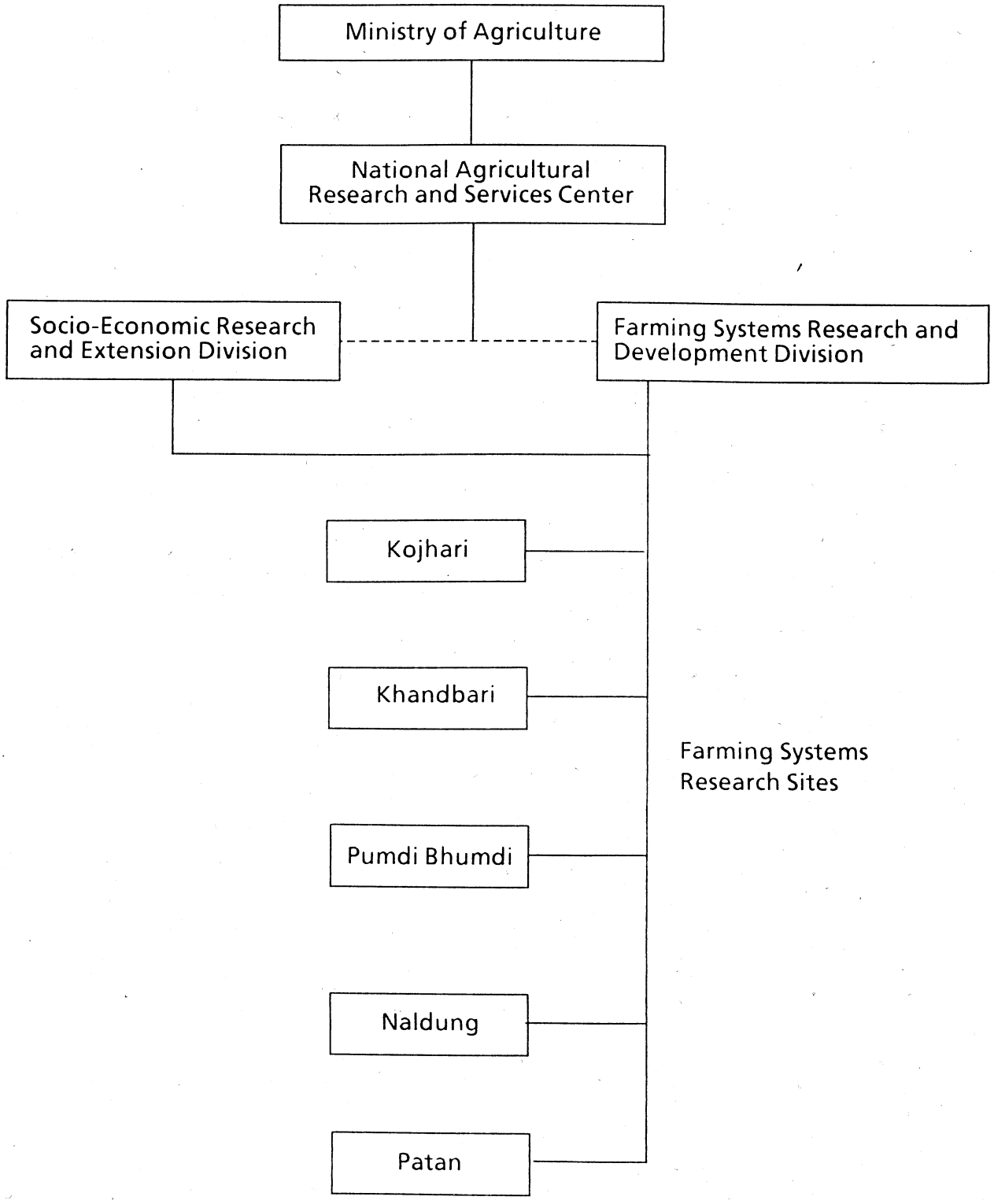
3) to facilitate collaboration across departmental, disciplinary and program lines (ICP,1983).

FSRDD reflects the change in emphasis from a cropping system-based program to a much wider farming system approach. SERED was created out of the socio-economic unit within the Cropping Systems Program and given a larger mandate for operation. This change reflected the recognition by the government of the important role of socio-economics in agricultural research which had been developed by the socio-economists in the Cropping Systems Program. SERED's national mandate and parallel status now allows it to support not only the socio-economic activities of the FSRDD but to implement needed socio-economic research in all programs under the National Agricultural Research and Services Center (NARSC), including disciplinary divisions and commodity programs.

Both of these new divisions come under the jurisdiction of NARSC and are technically supported and partially funded by USAID through the Agricultural Research and Production Project which has continued to provide support for many of the Integrated Cereals Project programs.

FSRDD has continued to use many of the Cropping Systems Program's Hill sites but has switched to a farming systems-based approach. Cropping system sites in the Tarai have been closed and additional new sites in the Hills have been established in line with the government's emphasis on the development of the Hill areas. The organization of the division is shown in Chart 9.

Chart 9: Organization of Farming System Research Development Division (1987)



Source: No-Frills, 1986.

As the Farming Systems Research and Development Division has just started its OFCOR activities, it is difficult to make any assessment regarding their organization and management.

Many of these processes are still evolving out of the former Cropping Systems Program. Difficulties in securing sufficient personnel to give the program a multidisciplinary team and building linkages with the other disciplines and commodity programs have been a major problem. The Farming Systems Research and Development Division, however, has maintained a good relationship with SERED and the two programs actively cooperate in many areas related to OFCOR.

Internal Organization of OFCOR

The Farming Systems Research and Development Division uses a center-based staff located at the division's heaquarters in Kathmandu to oversee field activities at the farming system sites. The internal organization is similar to that of the Cropping Systems Program except that the socio-economic unit which was formerly within the Cropping Systems Program has now been transferred to SERED.

Many of the staff now in the FSRDD have had experience working in the Cropping Systems Program. The organization of OFCOR is shown in Table 18.

Development and Management of Human Resources

Profile of staff. Table 19 provides a profile of the senior staff at FSRDD headquarters. Of the senior research staff, all are Nepalese except the expatriate farming systems advisor provided by the Agricultural Research and Production Project. Slightly over half the staff have graduate degrees (MSc) and all have five years or more research experience as well as on-farm research experience. The Socio-Economic Research and Extension Division is staffed by four socio-economists, one junior technican and three data enumerators. One expatriate socio-economist is also provided by the Agricultural Research and Production Project. The present head of SERED was formerly the senior socio-economist in the Cropping Systems Program's socio-economic unit.

The majority of staff now in FSRDD and SERED are permanent government employees who have been assigned to work on deputation (temporary assignment). Though the government has created FSRDD and SERED as divisions, they have not yet created permanent staff positions within them. This has limited their ability to develop the dedicated multidisciplinary core staff that is required to effectively address farming systems problems and to initiate appropriate field activities at the sites. Until the government resolves the issue of permanent staff for the new divisions, it will be difficult for the program to function effectively and to expand to fulfill its mandate.

Recruitment mechanisms. The recruitment policy of using only government staff in the new division as opposed to project-hired staff has been developed out of the lessons learned from the Cropping Systems Program, which had difficulties recruiting permanent staff. But these lessons have not been able to be

Table 18: Internal Organization of OFCOR in the Farming Systems Research Development Division

Research Teams	Team Members		Total time spent by team members at site	Number of OFCOR trials conducted in last year	Total number of farmer collaborators
	Total	No.			
FSRDD – Center-Based Team	9		5- to 7-day Samuhik Bhraman takes place twice a year in each FSR site.	205	285
– Agronomist		1			
– Extensionist		1			
– Agriculturalists		5			
– Pasture Development Officer		1			
– Expatriate FSR Advisor		1			
Farming System Sites					
1. Pumdi Bhumdi FSR Site	6		Based at Site	50	70
– Site Coordinator		1			
– Junior Technicians		2			
– Field Assistants		3			
2. Khandbari FSR Site	5		Based at Site	40	65
– Site Coordinator		1			
– Junior Technician		1			
– Field Assistants		3			
3. Kot Jahari FSR Site	5		Based at Site	40	55
– Site Coordinator		1			
– Junior Technician		1			
– Field Assistants		3			
4. Naldung FSR Site	5		Based at Site	20	25
– Site Coordinator		1			
– Junior Technicians		2			
– Field Assistants		2			
5. Patan FSR Site	4		Based at Site	55	70
– Site Coordinator		1			
– Assistant Agronomist		1			
– Field Assistants		2			

Source: No-Frills Survey, 1986.

Table 19: Profile of Senior Research Staff in the Farming Systems Research Development Division (1987)

Discipline	Gender Male/ Female	Age	National/ Expatriate	Salary level per month (Rs.)	Educational level	Experience Agriculture (Years)	Experience in OFR (Years)
Division Chief	M	43	National	2200	MSc	19	6
FSR Advisor	M	35	Expatriate	NK	PhD	NK	NK
Senior Agronomist	M	48	National	2200	MSc	20	NK
Site Monitor	M	35	National	1700	MSc	11	10
Site Monitor	M	34	National	1700	MSc	10	10
Site Monitor	M	30	National	1600	BSc	5	5
Junior Officer	M	40	National	1700	BSc	15	5
Junior Technician	M	46	National	1100	ISc	25	10
Pasture Officer	M	35	National	1700	BSc	10	5

Notes: US$ 1 = Rs. 21.90.
NK = Not known.
Age and salary levels are estimated.

implemented because the government has failed to create permanent positions within the divisions. The deputed staff in these divisions are ultimately responsible to their home division/program. Other staff have been hired by the Department of Agriculture on a project-temporary basis (e.g., they are not permanent government employees) to support these programs, but this has resulted in the same staff continuity and training problems that affected the Cropping Systems Program. At the farming system sites, the field assistants, as in the Cropping Systems Program, are locally hired farmers who are willing to work with the local field staff and other farmers in implementing and monitoring the field programs. They are paid out of funds provided directly by the Agricultural Research and Production Project.

Methodologies Adopted to Implement OFCOR

The Farming Systems Research and Development Division uses farming system sites to test and verify appropriate technologies that can be extrapolated to other areas with similar agro-ecological characteristics. New sites, which have been established to replace the sites closed in the Tarai, have been selected by the FSRDD agronomists in the same manner as was done in the Cropping Systems Program. Once the sites are selected, socio-economic surveys are carried out by SERED along the same lines as in the Cropping Systems Program. SERED then provides this information to FSRDD once it has been analyzed.

To establish the initial priorities for research at each site a samuhik bhraman is organized with SERED's cooperation and carried out over a five- to seven-day period. As this is a multidisciplinary tool, middle-level research staff from various disciplines participate at the request of the Chief of the Farming Systems Research and Development Division. Team members include agronomists, horticulturalists, socio-economists and livestock specialists. Five to seven days are spent at each farming system site to meet with farmers to identify their problems and constraints and to prioritize subsequent research activities. Initial reports are prepared in the field and discussions are held with local field staff and farmers on appropriate design of trials for their area. After team members return to their parent disciplines, appropriate trials for the identified priority areas are developed. Trials at any one site may consist of a number of different types from crops to livestock. Subsequent samuhik bhramans are carried out at the sites twice a year to assess the performance of the farming system trials and to assist with the reinforcement, realignment or revision of research trials and priorities if needed. These follow-up samuhik bhramans usually last for two to three days.

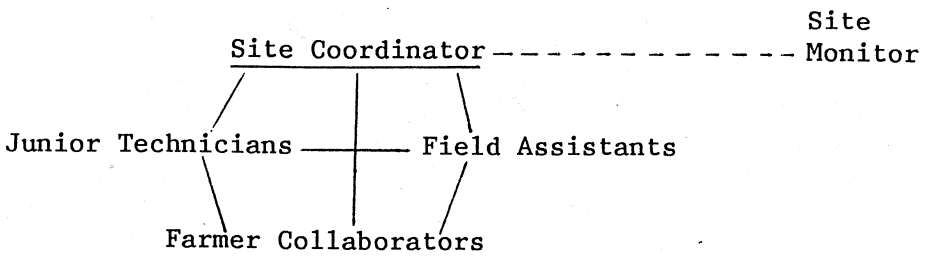
Management of OFCOR

FSRDD management practices follow many of the same principles as did those in the Cropping Systems Program.

Management and supervision of field operations. At each farming system site there is a site coordinator (officer level) who is responsible for the daily operation of site activities. Site coordinators are either agronomists or persons trained in extension (minimum BSc) who have been given additional training (short-term

training outside of Nepal) in farming systems research. This training has been provided by the Agricultural Research and Production Project. Many of these site coordinators were involved with the Cropping Systems Program and have had considerable experience in conducting on-farm trials. The site coordinators are responsible for organizing trials in farmers' fields. They are assisted by one or two junior technicians and three to four field assistants who are locally hired, literate farmers. Chart 10 illustrates the site-level organization.

Chart 10: Site-Level OFCOR Organization Chart



Site-level staff are supervised by center-based senior agronomists and site monitors. Site monitors, who are senior research staff, act in liaison between the center and the farming systems sites. During the Cropping Systems Program it was found that the site coordinators spent a considerable amount of time travelling back and forth to the center for meetings and discussions, and for following up inputs for trials. This often disrupted the smooth implementation of site activities, so the use of site monitors now allows the site coordinator to be resident at the site to coordinate and manage site activities while at the same time provides the site coordinator with a regular information linkage to the center. Site monitors visit the sites during the bi-annual samuhik bhramans as well as on a regular basis during the implementation of the trials (providing trial inputs, monitoring and data collection). They also visit the sites when requested by the site coordinator. The Chief of the Farming Systems Research and Development Division has overall responsibility to supervise and coordinate all OFCOR activities at the sites.

Planning, programing and review mechanisms. According to government regulations, each disciplinary division is required to submit an annual plan to the National Planning Commission and the Ministry of Finance through the National Agricultural Research and Services Center for the coming year's programs along with a corresponding annual budget. FSRDD staff fix the number of trials to be conducted at each site based on the available manpower and the budget allocated for that site. In planning the number of trials for each site, the FSRDD Chief discusses the type of research trials required to meet the research priorities at each site with the agronomists and site monitors. Unlike the Cropping Systems Program, site coordinators, who after all are the primary sources of knowledge about the sites, are now requested to attend these planning

meetings, which take place twice a year (for winter and summer crops), to discuss and finalize the plans for each site. Reports prepared from the samuhik bhramans conducted at the farming systems sites are also an important source of information for the planning and review process.

Additional sources of information used for the internal planning, review and programming processes of the FRDD are the annual farming systems working group meetings, which bring together all research staff working with or associated with farming systems research programs (or other village-level OFCOR programs) in the country and the Farming Systems Research Coordinating Committee, which deals with policy-related issues.

Management of farmer collaboration. Farmers are selected at the farming systems sites in the same manner as for the Cropping Systems Program sites. The site coordinator is responsible for the selection. Farmers who participate in the trials are given free inputs for the selected trial plot. With guidance from the field assistants, the farmers carry out all the necessary field operations as per the instructions of the trials.

Data analysis and dissemination of information. The Farming Systems Research and Development Division has been actively cooperating with the Socio-Economic Research and Extension Division to standardize the data analysis and reports of OFCOR trials. Data collected at the farming systems sites by the field assistants is sent by the site coordinator to the center for agronomic and social-economic analysis by the FSRDD agronomists. Assistance is provided by SERED for carrying out more detailed socio-economic analysis when necessary. Reports are published and distributed to other programs and divisions as well as presented at the national farming systems working group meetings.

Organization and Management of Linkages and Information Flows

Within the national agricultural research system. Within the Farming Systems Research and Development Division, linkages within the national agricultural research system have been developing but are still very weak. Much of this weakness is the result of the lack of multidisciplinary staffing within FSRDD and the limited support from the commodity programs and disciplinary divisions. Presently, the FSRDD only has agronomists, despite its multidisciplinary research mandate. Links with the livestock and forestry programs have yet to be established.

Since the main job of farming systems research is the verification, modification and packaging of the technologies generated by the station-based research programs, the commodity programs and disciplinary divisions should make use of the sites as their field laboratories (Pant, 1988). However, these cooperating programs have not yet identified resource persons to give technical support to FSRDD in related areas for mutual benefit. An initiative made by FSRDD in 1988 proposed to help integrate the programs within the national agricultural research system and to strengthen the institutionalization of the farming systems approach by initiating and coordinating a station-based farming systems program within the command areas of the Research Outreach Programs of the commodity

programs and agricultural stations (Pant, 1988). This proposal would bring the outreach progams and FSRDD into direct collaboration and would help strengthen the linkages with the commodity programs and disciplinary divisions.

Though the Farming Systems Research and Development Division does not have a direct link to the policy-making bodies, it does participate in a Farming Systems Coordinating Committee which is chaired by the Chief of the National Agricultural Research and Services Center and composed of the chiefs of the commodity programs and disciplinary divisions. Since the committee has only met once, it is difficult to judge how effective it will be in strengthening and institutionalizing the farming systems program in Nepal.

Within and between on-farm research programs. The annual farming systems research working group meetings, organized through the National Agricultural Research and Services Center and hosted by the Farming Systems Research and Development Division, provide the major vehicle for formal contact with other OFCOR programs. During these annual three-day meetings, reports from the different OFCOR programs are presented and reviewed, technical issues are discussed and recommendations for delivery to the extension programs are developed. On average, 60 to 80 participants attend these meetings. They include representatives from the Ministry of Agriculture, the Department Of Agriculture (extension), district agricultural development officers from the areas where farming systems programs are being implemented, heads of the crop commodity programs and disciplinary divisions, research staff from Pakhribas Agricultural Center, Lumle Agricultural Center and other projects as well as representatives from the aid donors.

One of the major benefits of the annual meetings is that it promotes greater cooperation and collaboration between programs. Staff from the Farming Systems Research and Development Division have been invited to participate in the samuhik bhramans at Lumle and Pakhribas Agricultural Centers. Research staff from FSRDD have been involved as resource persons in training programs for officers, junior technicians and farmers in several projects working with OFCOR programs. These have included training of subject matter specialists for the Agricultural Research and Extension Project and junior technicians for the Rapti Integrated Project and the Hill Food Production Project.

Linkages with the OFCOR staff at the national commodity programs are also maintained to some extent as they provide the inputs for many of the trials at the farming systems sites. Results of the individual trials conducted at the farming systems research sites are presented in the annual crop working group meetings, which are also organized by the National Agricultural Research and Services Center.

Farmers and on-farm research staff. As in the Cropping Systems Program, the field staff at each site live in the area and work out of an office situated near the trial sites. Field staff visit the trials of participating farmers three to four times a month, and as in the Cropping Systems Program, field days within the sites and tours to other farming systems sites and agricultural stations are also used. In addition, informal contacts as a result of the FSRDD

site staff living within the site area, have also been an important avenue for information flows from farmers to OFCOR staff.

The use of the samuhik bhraman brings researchers into direct contact with the site farmers for the purpose of learning more about the problems of farmers in that area. However, experience from conducting several samuhik bhramans at the farming systems sites has revealed that the information coming from farmers may be biased to comply with extensionists' advice or with political and social pressures within the community (Mathema et al., undated). Techniques need to be developed to ensure that the farmers provide information that accurately reflects their present practices so that appropriate trials can be developed.

So far experimenting farmers have not been utilized to any extent in the farming systems program. Some information regarding local farmer experimentation has been picked up by researchers during the samuhik bhramans but there is no concerted effort to identify and involve farmers who are doing informal research in their own fields.

Extension agents and on-farm research staff. As with the Cropping Systems Program, little contact is made with the extension staff in the actual work at the farming systems sites as all trial implementation and monitoring is done by the FSRDD site staff. What little contact is made is primarily for training extension agents in other locations to implement the pre-production verification trials, which further verify the results derived from the site programs. Farming Systems Research and Development Division staff have recognized this weakness (the Cropping Systems Program had similar problems) and are trying to encourage the participation of the district agricultural development officers and local junior technicians in the samuhik bhramans at the farming systems sites.

Experiment station research and OFCOR. As the national commodity programs provide material for the farming systems sites, linkages between the programs have been maintained. However, as in the Cropping Systems Program, the linkage is still one way since FSRDD trial programs are perceived as testing vehicles for commodity program recommendations. Input from the sites has had little impact on changing the research priorities of the commodity programs. Since most of the commodity programs are involved in their own research outreach programs, they do not consider the work of the Farming Systems Research and Development Division to be an integral part of their own programs.

Participation of on-station research scientists in the Farming Systems Research and Development Division samuhik bhramans has been relatively good for sites near their own command areas, especially the Naldung site which lies just outside Kathmandu, but not for sites located in remote areas. One major reason for this is the limited travel allowances and per diems allocated to station-based staff for visiting outside sites. This limited participation of on-station scientists in the samuhik bhramans has circumvented the ability of the Farming Systems Research and Development Division to strengthen their linkages and integration with the commodity programs and disciplinary divisions.

Management of Financial Resources

Budgetary systems. Budgeting procedures are the same as those described for the Cropping Systems Program. Annual budgets are submitted along with the division programs for the center and for each site. Budgets are released on a trimester basis and are often late.

Budgets and budget trends. Table 20 shows budgets approved for fiscal year 1985-86 for the Farming Systems Research and Development Division central office and one of the five farming systems sites, Pumdi Bhumdi. While the approved budget for the central office is $80,245, the actual budget expenditures for the year were less than $19,000 (approximately 23% of the approved budget). For the Pumdi Bhumdi farming systems site, the actual expenditures were 55% of the total approved budget, about $5,400. The shortfall in actual expenditures is largely due to the limited staffing within the FSRDD and the late arrival of the trimester budget releases, which hampers the effective running of the programs. Within the budgets, the largest share is for staff salaries, allowances and per diems. This accounts for 77% of the approved budget for the FSRDD central office and 71% of the budget for the Pumdi Bhumdi site. Despite the problems related to the shortfall in expenditure, the approved budgets for fiscal year 1986/87 were expected to be increased by 10% to 15%.

LUMLE AGRICULTURAL CENTER

Historical Development and Objectives

The Lumle Agricultural Center (LAC) was established in 1968 by the British Government, at the request of the Government of Nepal, as an independent organization to resettle ex-Gurkha soldiers of the British army into the mid-Hill area of western Nepal. The primary purpose of LAC was to teach ex-soldiers improved farming practices and provide them with technical support in the field. The center, which is wholly funded by the British Government's Overseas Development Administration, is located in Kaski District, 20 km from Pokhara, the regional headquarters of the Western Development Region (Figure 2). The center is not accessible by a motorable road and requires several hours traveling on foot to reach. It consists of 57 ha, located at an altitutde between 1550 and 1900 meters, of which 16 ha is used for agricultural research activities. Annual rainfall is 5500 mm per year with the majority of rainfall (4500 mm) falling between June and September.

Until 1974, LAC was primarily engaged in farmer training programs at the center, extension activities in the field, and the production of agricultural inputs (seed multiplication programs for cereal and vegetable crops, fruit and fodder trees, and livestock). It provided technical support from its on-station adaptive research program to its own extension staff. This created from the very beginning a strong linkage within the center between training, extension and research. In 1974, the Government of Nepal requested that LAC expand its program mandate to include all farmers within the LAC target area. The present target area now covers 27

Table 20: Farming Systems Research and Development Division Central Office Budget and Pumdi Bhumdi Farming Systems Site Budget for Fiscal Year 1985-86

Budget Description	Farming Systems Research and Development Division			
	Central Office	%	Pumdi Bhumdi Site	%
	(In U.S. Dollars)			
Salary	58,147.95	72.5%	5,787.84	58.7%
Allowances	568.18	0.7%	454.55	4.6%
Per Diems	3,125.00	3.9%	738.64	7.5%
Service Charges	1,477.27	1.8%	113.64	1.2%
Other Services	170.45	0.2%	113.64	1.2%
Rent	454.55	0.6%	397.73	4.0%
Repair & Maintenance	909.09	1.1%	170.45	1.7%
Stationary	835.23	1.0%	62.50	0.6%
Journals, Newspapers and Magazines	340.91	0.4%	85.23	0.9%
Fuel for Vehicles	1,818.18	2.3%	340.91	3.5%
Fuel for Other Purposes	340.91	0.4%	113.64	1.2%
Office Goods	1,704.55	2.1%	1,136.36	11.5%
Prizes and Donations	3,409.09	4.2%	0.00	0.0%
Contingencies	340.91	0.4%	56.82	0.6%
Furniture	2,727.27	3.4%	227.27	2.3%
Means of Transport	352.27	0.4%	0.00	0.0%
Machinery and Tools	3,522.73	4.4%	56.82	0.6%
Total US$	80,244.55	100.0%	9,856.02	100.0%

Note : 1985 currency exchange rate: 1 US$ = 17.60 Nepalese Rupees
Source: Farming Systems Research and Development Division and Pumdi Bhumdi Farming Systems Site, 1986

panchayats (800 km^2) in the three mid-Hill districts of Parbat, Myagdi and Kaski. The target area represents the heterogeneity of the Hill areas with altitudes from 917 meters to over 3,050 meters. The rainfall patterns for the region range between 1358 mm and 5500 mm.

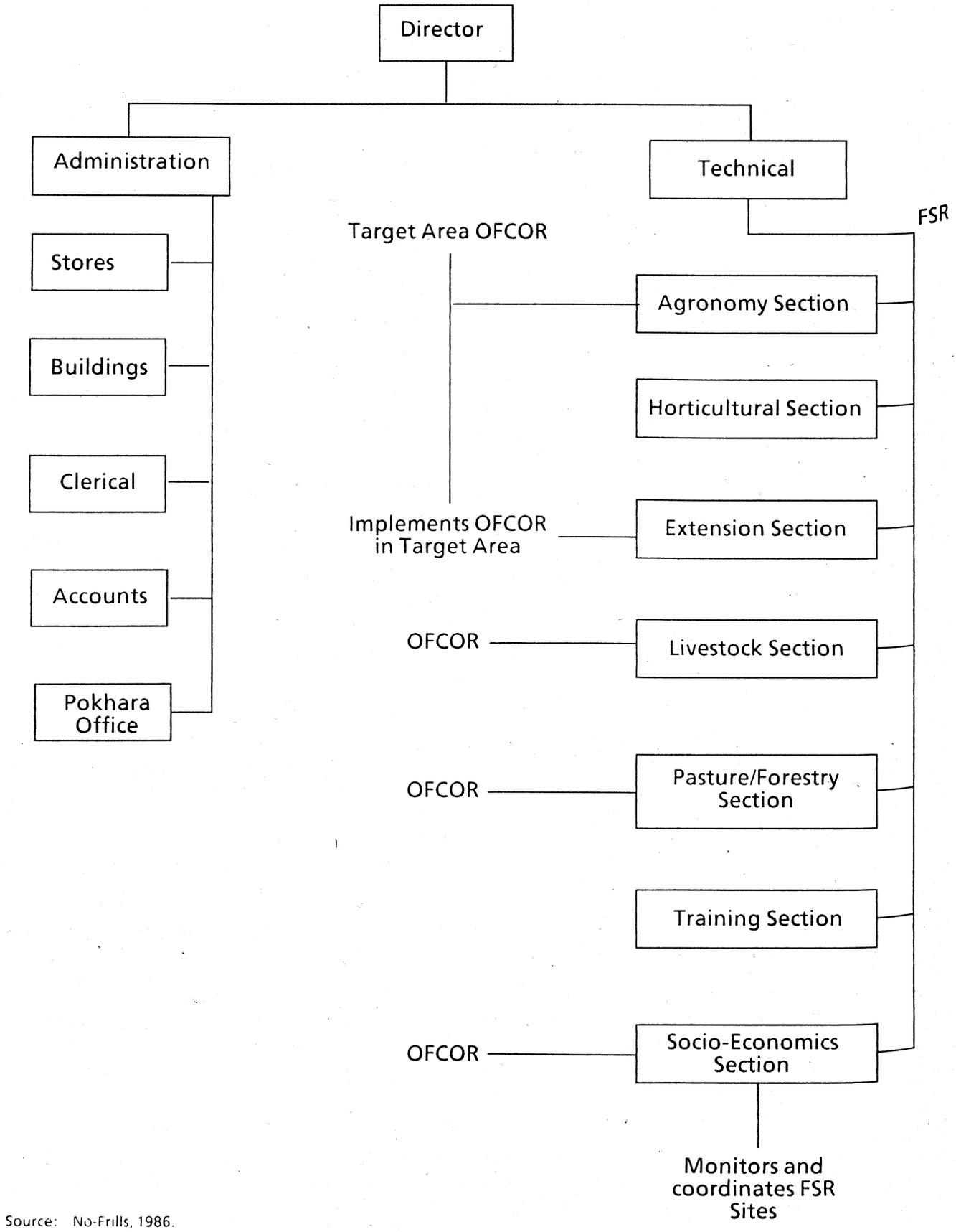
In 1975, Lumle Agricultural Center initiated an OFCOR program. Motivation for the development of this program came from the center's experiences with the farmer training program which, with the expansion of its clientele group, had moved from the center to villages within the target area. Many farmers, in the course of the training programs, raised problems that they were encountering in their fields and looked to the staff at the Lumle Agricultural Center for solutions. As solutions to many of the problems were not readily available, Lumle Agricultural Center staff began investigative research into the problems and constraints of the farmers. The objectives of Lumle Agricultural Center's OFCOR program are to improve land-use practices, diversify and intensify cultivation techniques, reduce post-harvest losses and plant forests and fodder in appropriate areas. The OFCOR program has been designed to complement the other station activities.

The center is presently organized along multidisciplinary lines with disciplinary sections for agronomy, horticulture, livestock, forestry, extension and socio-economics (Chart 11). The head of each section is responsible for the on-station and on-farm activities of that particular section. Before the establishment of the extension section in 1987, each section was responsible for its own extension activities. OFCOR activities have been initiated in the agronomy, horticulture, forestry and livestock sections. All research staff in these sections are engaged in both on- and off-farm research activities. They design appropriate on-farm trials using material obtained from the national commodity programs and disciplinary divisions, which are then implemented by the extension section staff in the target area.

In 1984, LAC adopted a farming systems approach built around the multidisciplinary staff at the center to strengthen its OFCOR program. Several key events led to the development of this new approach. In 1983, a new expatriate director arrived at Lumle Agricultural Center. After touring the target area, the new director felt that the narrow focus of the individual sections and the lack of coordination between the research activities of the sections was not adequately serving the needs of the target area clientele. This view was further reinforced by a baseline survey done by the planning unit (now the socio-economic section) which indicated that many of the technologies and recommendations developed by the center, although technologically feasible, were not being adopted by the local farmers. At the same time, the Cropping Systems Program was publishing reports that identified constraints encountered by their staff in the cropping systems approach in the Hill Region. These reports emphasized the need for a more "holistic" farming systems approach.

In June, 1984, the center held a meeting for all section heads to discuss the concept of farming systems research. At the meeting it was agreed that all section heads and the director would make a

Chart 11: Organizational Chart of Lumle Agricultural Center (1987)



Source: No-Frills, 1986.

10-day "combined trek" using rapid rural appraisal techniques through the target area to better understand the problems and constraints of the farmers. Prior to departure, the planning unit provided all staff with background information regarding the agricultural, social and economic features of the different areas to be visited. After this initial "trek" it was decided to establish farming systems sites in two of the villages that had been visited. A second "combined trek" was conducted to these two villages to establish research priorities and to develop appropriate trials. This methodology has since been adopted by both the Farming Systems Research and Development Division and the Pakhribas Agricultural Center. This was the origin of the samuhik bhraman. The socio-economic section (which was previously the planning unit) has the responsibility for monitoring and coordinating the work at the farming systems sites. One additional village-based site has recently been added. The most recent development in its on-farm research work has been the use of research thrusts which deal with a defined problem using an interdisciplinary team. Three thrusts have been developed so far, they include soil fertility, fodder/pasture and income generation.

With the reorganization of the national research system in late 1985 and the technical integration of Lumle Agricultural Center into the National Agricultural Research and Services Center, the center's position as a regional research center is increasingly being recognized. In 1986, Lumle Agricultural Center entered into an agreement with the World Bank-funded Hill Food Project to provide research and technical support to its training and visit system which was being implemented by the Hill Food Project in four neighboring districts: Lamjung, Gorkha, Syangja and Tanahun (see Figure 2).

These four districts now provide Lumle Agricultural Center with a research command area similar to that of Parwanipur Agricultural Station. The center provides training to the subject-matter specialists and junior technicans within the district agricultural development offices as well as research support, technical advice and trials for implementation through these offices. As in the Parwanipur Agricultural Station Outreach Program, bimonthly and semi-annual meetings are held at Lumle Agricultural Center with the district agricultural officers, subject-matter specialists and junior technicians to review and discuss OFCOR activities within the districts. This involvement has helped integrate Lumle Agricultural Center's activities into the government extension program.

Internal Organization of OFCOR

OFCOR activities take place at three selected farming systems sites as well as through the individual sections within the target area. OFCOR activities at the farming systems sites are planned and organized jointly by all sections. The trials at the sites, which are villages, are implemented and monitored by site-based staff from the socio-economic section.

OFCOR activities conducted by the individual sections are planned and designed by the sections concerned. Field implementation of the trials for the agronomy and horticultural sections is done by the field-based staff from the extension program and monitored by the

sections concerned. Trials for the forestry and livestock sections are implemented in the field by their own field assistants.

All research staff are involved in both on- and off-station research activities. OFCOR work is done by the individual sections within the target area as well as jointly at the farming systems sites and through the "thrust" groups. A task force is identified with a coordinator to implement each of the three problem-solving thrusts (soil fertility, fodder and income generation). The thrusts cut across the administrative boundaries of all sections, and the thrust coordinator may come from any section. The thrust's research plans are developed by the multidisciplinary thrust group who report their activities at the monthly technical meetings held at the center for all senior research staff.

Since the center has accepted the farming systems approach as the primary OFCOR methodology, it has decided that all sections should spend 60% to 75% of their research time in on-farm research (except for livestock, which spends 40%). The research teams and the organization of OFCOR activities are shown in Table 21.

Development and Management of Human Resources

Profile of staff. Table 22 provides detailed information on the education, experience and training of the 16 senior staff at Lumle Agricultural Center. Although the center is externally funded, the majority of the scientific staff are Nepalese. Of the 10 senior research staff members, representing nine disciplines, over half have graduate degrees, and the majority have over five years of research experience. It is interesting to note that the socio-economists are the least experienced.

Recruitment mechanisms. The staff at the center are all hired directly by the center for the duration of the project (presently the project has funding guarantees from the British Government through 1995). The staff have mostly been recruited from among new BSc graduates in agriculture, forestry and animal science. At the request of the Nepalese Government, the center does not recruit permanent gazetted staff away from existing government offices. Several of the senior research staff positions are, however, provided by the government on deputation. Lumle Agricultural Center has found that this arrangement provides the center with well-qualified and experienced staff, promotes linkages with government programs, and allows the center to fill positions for which there are staff shortages within the country, i.e., veterinarians. Presently, there are seven staff members on deputation from the government. These include an agronomist, extension officer and horticulturalist, three veterinarians and one livestock officer. These individuals have been on deputation to the center for periods from two to 18 years. While on deputation, their salaries are paid by the center at the Lumle Agricultural Center rate in addition to their government pension payments.

Lumle Agricultural Center's technical field staff (regular employees) are all recruited from the local target area. This practice has allowed the center to develop a core staff that is familiar with local farmers and conditions. Field assistants, who help implement trials and collect data, are local farmers.

Table 21: Organization of Research Teams at Lumle Agricultural Center (1986)

Research Teams	Sites	Team Members			Team members by discipline	Total time spent by team members at site	Total number of on-farm trials conducted in last year	Total number of farmer collaborators	Number of OFR Sites
		Total	full time	half time					
1. ——————— Farming Systems Research (all sections together)	Parbat and Kaski	16	10	6	Director Agronomist Horticulturalist Extensionist, Socio-Economist, Forestry/ Pasture Officer Livestock Officer Veterinarian	10- to 15-day combined trek takes place twice yearly.	9	6	2[a] (Tapu and Chhomro)
2. ——————— Agronomists	Parbat, Kaski and Myagdi	10	10		Agronomist Senior Supervisors Superintendents Field Assistants	Frequently[b]	39 (includes FFTs on on rice, wheat and maize)	30	27 Panchayats
3. ——————— Livestock Specialists and Veterinarians	Parbat, Kaski, Myagdi, Lamjung and Manang	24	24		Livestock Specialist Senior Supervisors Superintendents Field Assistants	Freqently	20		27 Panchayats
4. ——————— Horticulturists	Parbat, Kaski and Myagdi	10	10		Horticulturist Senior Supervisors Superintendents Field Assistants	Frequently	16	10	2 (Tapu and Chhomro)

Notes: a - A third site has been added recently.
b - Senior research staff visit sites when needed to assist with trial implementation.
Source: No-Frills Survey, 1986.

Table 22: Profile of Senior Research Staff at Lumle Agricultural Center (1987)

Discipline	Gender Male/ Female	Age	National Expatriate	Salary level per month (Rs.)	Education Level	Experience Agriculture (Years)	Experience in OFR (Years)
Director	M	NK	Expatriate	NK	MSc (Ext)	NK	NK
Agronomist	M	33	National	5200	MSc/M.Phil	10	10
Agronomist	M	23	National	NK	BSc (Agri)	2	NK
Extensionist	M	42	National	5200	MSc (Ext)	18	18
Extensionist	M	27	National	NK	BSc (Agri)	4	NK
Livestock Officer	M	36	National	5200	MVSc	14	10
Veterinarian	M	42	National	5200	MVSc	18	NK
Veterinarian	M	33	National	5200	MVSc	9	NK
Veterinarian	M	33	National	5200	MVSc	8	NK
Horticulturist	M	37	National	5200	M.Phil (Hort)	16	2
Horticulturist	M	35	National	NK	BSc (Agri)	7	NK
Foresty/Pasture Officer	M	31	National	NK	BSc (Forestry)	6	1
Fodder Officer	M	28	National	NK	BSc (An Sci)	4	NK
Training Officer	M	33	National	NK	BSc (Agri)	7	2
Socio-Economist	M	28	Expatriate	NK	MSc (Agri Eco)	2	1
Socio-Economist	M	30	Expatriate	NK	MSc (Agri Eco)	2	1

Notes: US$ 1 = Rs. 21.90.
NK = Not known
Age and salary levels are estimated.

In addition to the local staff, there are three expatriates provided on contract by the British Government. One is the center director, who is responsible for the organization and management of Lumle Agricultural Center, while the other two are in the socio-economics section. (The permanent Nepalese socio-economist is currently on study leave for an MSc in the UK.)

Methodologies Adopted to Implement OFCOR

Site selection and research priority setting. Lumle Agricultural Center has now institutionalized the samuhik bhraman in its annual activity plan. These treks take place regularly twice a year for the winter and summer cropping seasons. They were used initially to select the farming systems sites and are now used to identify farmer problems and constraints at the sites, to adjust research priorities, and to develop appropriate trials. They are also used to monitor and evaluate the results of on-going OFCOR activities at the sites as well as at the individual section trials within the target area. Each trek takes approximately 10 to 15 days and all senior research staff participate. Because Lumle's target area is relatively small, all three farming systems sites are within one day's walk from the center; however, each site represents the different agro-ecological conditions found in the area.

Lumle Agricultural Center is in the process of developing recommendation domains to further define the farming systems research sites so that the research program and recommendations from the sites can be made more applicable to specific areas within the western Hills. The socio-economic section is taking the lead in this activity by collecting and verifying data from the target area on crops, agricultural infrastructure, altitude, aspect and slope, and is developing a series of maps for the major cropping patterns.

The institutionalization of the samuhik bhraman has allowed for the development of personal links between senior research staff and the technical staff at the sites as well as with the participating farmers. On-farm research led to the development of "research thrusts" which now make up the farming systems research program.

Trial methodology. Lumle participates with the national commodity programs and disciplinary divisions in the evaluation of new varieties and technologies through farmer field trials. These are carried out both at the farming systems sites and through the individual sections in the target area. In addition to farmer field trials, minikits and pre-production verification trials, with materials from the national programs and from the center, are also used to test new varieties and cultural practices at the OFCOR sites. The trials carried out at the farming systems research sites are jointly designed by the sections concerned. Trials implemented by the individual sections are designed by those sections, but the emphasis on work at the farming systems sites has resulted in more collaboration between sections in the design and implementation of their own trials.

Management of OFCOR

Management and supervision of field operations. Each of the three village farming systems sites is staffed by a farming systems

research supervisor (junior technical staff) from the socio-economic section who lives at the site and works with the collaborating farmers to monitor the research trials. The farming systems research supervisor has a field assistant who is a local farmer from the site, to assist in the monitoring and recording of data for the trials. Superintendents (senior technical staff from the disciplinary sections based at the center) visit the sites to monitor their section's trials on a regular basis. They also monitor the trials being implemented by the extension section staff for them in the target area. Each farming systems site has approximately 15 to 20 trials per year. On average, this is about five trials per junior staff member. These include 4-5 interdisciplinary trials designed and implemented through the thrust groups in addition to verification, cropping pattern, varietal and husbandry trials implemented by the individual sections.

Senior research staff members from the center normally visit the trial sites (both farming systems research and other sites within the target area) two to three times during the cropping season, usually at planting and harvesting times, and during the regular samuhik bhramans.

The farming systems research supervisors and staff from the extension section report to the monthly technical meetings at the center. They also have discussions with the sections involved in implementing the trials at the farming systems research sites and in the target area.

Planning, programing and review mechanisms. Several methods for planning, programming and review are used. For the farming systems sites, a farming systems research working group committee has been formed with senior research representatives from all the sections. This committee works out the annual research plan for each of the sites. Significant inputs into this planning come from the annual samuhik bhramans. During the first of the two annual samuhik bhramans, research plans and priorities are developed in the field through discussions with local farmers and field staff. A draft report of the proposed research trials is written while the working groups is still in the field, and it's discussed with the farmers to gauge their reactions. At the center, plans are finalized in the farming systems research working committee. The second samuhik bhraman provides a review of the earlier trials and gives the center staff the chance to redefine and modify the trials as necessary with the collaborating farmers.

The monthly technical meeting at the center also provides a forum for the reporting and review of all station-based and field activities. Field staff from the farming systems sites and the extension section report on site activities during these meetings in addition to reporting to the individual sections.

Individual section trials are planned by each section for implementation within the target area. These trials, along with the trials for the farming systems sites and thrust groups are presented and discussed in an annual work-program meeting, chaired by the Director and attended by all senior research staff. The center has adopted a trial/survey protocol system in which all on-farm research activities (both research trials and socio-economic surveys) are discussed and jointly approved by all senior staff. This joint

discussion has led to greater collaboration and coordination among the sections in both on-station and on-farm activities.

Management of farmer collaboration. Participating trial farmers, who are representative of the area, are selected primarily by the field staff based on their personal experiences working in the area and according to the needs of the trials being implemented by the sections. At the farming systems sites, the farming systems research supervisor tries to ensure that participants are selected from the various socio-economic groups represented within the site. In several cases, this selection has been done by the site farmers themselves. Both male and female participants are selected for the trials. At present, approximately 70% of the collaborating farmers are male; 30% are female.

Data analysis and dissemination of information. Field staff collect data from the trials using a standard format developed by the socio-economic section and handed over to the appropriate section at the center. Data from on-farm trials are analyzed by the section in charge of the trial. Results are published in report form and submitted to the director as well as circulated to the other sections. Results from the Lumle OFCOR programs are presented at the national working group meetings and are distributed to the different line agencies at the national, regional and district levels within the research system.

Within Lumle's target and research command areas, the center produces a quarterly newsletter, the Prabhidi Sangalo ("Package of Technology"), in the Nepali language, and distributes it to district agricultural offices, subject-matter specialists, junior technicians and farmers. The newsletter presents case studies of collaborating trial farmers and what they have done in trials, a crop calendar for the relevant season, the latest recommendations from Lumle, and a question-and-answer section which has proven very effective. The newsletter is written by an editorial committee which has representatives from all sections.

Organization and Management of Linkages and Information Flows

Within the national agricultural research system. At present, the center is closely linked technologically with the national commodity programs and disciplinary divisions through the National Agricultural Research and Services Center. This linkage is growing stronger as Lumle is being increasingly recognized as the regional research center for the western Hill area. Prior to this, linkages with the commodity programs and disciplinary divisions were primarily viewed as a source of inputs and information about new technology. With the increasing recognition of the expertise that Lumle has developed over the years, the linkage is now a strong and viable two-way connection. Lumle participates in both on-station and on-farm trial evaluations for the national commodity programs as well as collaborating with the crop commodity breeding programs in the screening of F2 lines of wheat maize, and rice (for cold tolerance, hail resistance, and high altitude). Similar work is also being done with the grain legume and potato programs.

Staff from Lumle regularly attend the national working group meetings organized for crop and farming systems research as well as in national seminars, and Lumle's trial plans and input requirements

are discussed during the crop working group meetings. Lumle has also invited research staff from the national crop and farming systems research programs to participate in their twice yearly samuhik bhramans and bears the cost for the outside participants from the government.

Within and between on-farm research programs. Lumle Agricultural Center maintained good relationships with the Cropping Systems Program and now the Farming Systems Research and Development Division programs. One of the FSRDD farming systems research sites (Pumdi Bhumdi) is located near the center, so research staff from Lumle have played an important role in advising the site staff on technical recommendations suitable for the area (based on their own experience), as well as participating in the FSRDD-SERED samuhik bhramans held at the site.

Participation in the national farming systems research working group meetings provides researchers from Lumle with an opportunity to discuss their program with researchers from the other farming systems research programs. This interaction has led to the sharing of experiences and methodologies, such as the samuhik bhraman, which was originally developed at Lumle.

Farmers and research staff. The samuhik bhraman has been very useful in developing a good flow of information between farmers and OFCOR staff. It allows the research staff to meet with farmers individually and in small groups to better understand their problems and constraints. Lumle has also been conducting training programs, farmer tours to farming systems research sites, field days at the center and socio-economic surveys in the target areas and at the farming systems sites. These activities have helped create strong linkages between the farmers in the target areas and OFCOR staff.

The cropping pattern research trials at the center provide an example of this flow of information. Researchers had identified the potato/maize combination as one of the major patterns in the Lumle target areas. Research work carried out in on-station trials and later in on-farm trials indicated a greater yield potential for the combination of an improved maize variety and an improved potato. Based on the results of the trials, this combination was given to the extension section for recommendation to farmers.

Later survey work on the acceptance of this recommended practice by the socio-economic section revealed that the farmers were adopting the improved maize component but not the improved potato. Subsequent surveys indicated that the farmers' evaluation of this pattern was not the same as that of the Lumle researchers. While the farmers were concerned with maximizing total yield, they were also concerned with another set of evaluation criteria for potatoes based on color, size, taste and market value. Researchers at the Center subsequently altered their evaluation criteria to include other characteristics more in line with those of the farmers in the target areas.

Extension agents and on-farm research staff. The Lumle Agricultural Center has it's own extension section and has thus far remained independent from the Government extension service within its own target area. However, the center is now attempting to establish links with the district and regional offices in charge of extension

activities. The center's participation in the Hill Food Project's training and visit system has been a key development to promote greater collaboration with the national extension program.

Management of Financial Resources

Budgeting systems. Section heads are responsible for developing the budget for their own section. A significant feature of this budgeting process is the trial protocol system which identifies the inputs (manpower, equipment and materials) required for each trial. This ensures that the trials that are planned and approved are funded for implementation. The budgets from each section are then sent to the administrative section head who reviews the proposed budgets with the section heads before submitting them to the director. Once the director approves them, the budgets are sent to the Overseas Development Administration for approval. Funds are released by the British Embassy in Kathmandu on two weeks' notice. Each section receives a monthly statement of accounts. Unlike the budgeting systems funded by the Government of Nepal, the center's activities have not suffered from the late release of funds. Lumle's budgeting system does not distinguish between on-farm client-oriented research and On-station research but its budget has been increasing every year. In 1984-85, the center's total budget was Rs. 8,131,807, while the budget for 1985-86 was Rs. 8,944,146. This represents an increase in the overall budget of almost 10%.

PAKHRIBAS AGRICULTURAL CENTER

Historical Development and Objectives

Established in 1973, the Pakhribas Agricultural Center (PAC) is located in the eastern Hill region of Nepal. Like its sister center at Lumle, the Pakhribas Agricultural Center was originally conceived as an agricultural training center for soldiers who had completed their service with the Gurkha regiments of the British army and were in the process of being resettled into their home areas. The center is situated on 80 ha in Dhankuta District. Lying between an altitude of 1280 and 2000 meters, the site is typical of the agro-ecological conditions found in the area. Funding for the center is provided wholly by the British Government's Overseas Development Administration.

In 1975, at the request of the Government of Nepal, the mandate of Pakhribas Agricultural Center was expanded to provide extension and training services for the entire farming community within their target areas. Initially the center's target areas covered two locations: the northern target area, which has eight Panchayats, and the local target area which has seven Panchayats. Together the northern and local target areas contain over 9,000 farm families.

During this period, the center consisted of technical sections for crop extension, engineering, forestry, livestock, horticulture, and administration. Station-based research supported the training and extension activities in the target areas through the introduction and testing of new technologies obtained from the national commodity programs and disciplinary divisions. These technologies were further field tested in the target areas through on-farm trials before being recommended to the local farmers through the center's own extension

section. This process coincided with the change in emphasis in the national commodity programs from a national perspective to a more regionally based testing and evaluation program.

Over the years, the emphasis at Pakhribas has expanded, and the initial training and extension functions are now supplemented by applied and adaptive research programs, production (multiplication programs for cereal and vegetable seeds, fruit and fodder trees, and animals) for distribution and diagnostic services. Center activities are now divided among 10 sections. Staff from all sections work together in a multidisciplinary approach to formulate and carry out work programs. Pakhribas Agricultural Center is slowly being recognized by the government as a regional Hill research center and is becoming more integrated into the national agricultural research system. One example of this is the seed testing laboratory at Pakhribas which supports the center's cereal and vegetable seed production programs. This laboratory has now been recognized as the official seed testing center for the eastern Hills Region by the government's National Seed Testing Program.

Until 1982, the center's agricultural and extension activities were confined to the northern and local target areas. Since 1983, the center has provided technical support to the Koshi Hills Area Rural Development Program, a British-funded project, which includes the center's target areas. Through this association, Pakhribas has become responsible for the agricultural research and development activities in the four districts that make up the Koshi Hills area: Dhankuta, Terathum, Sankhuwasabha and Bhojpur. This new research command area includes more than 100,000 farm families in a very diverse, remote (access is mainly by foot) agro-ecological area which covers almost 7,000 km^2.

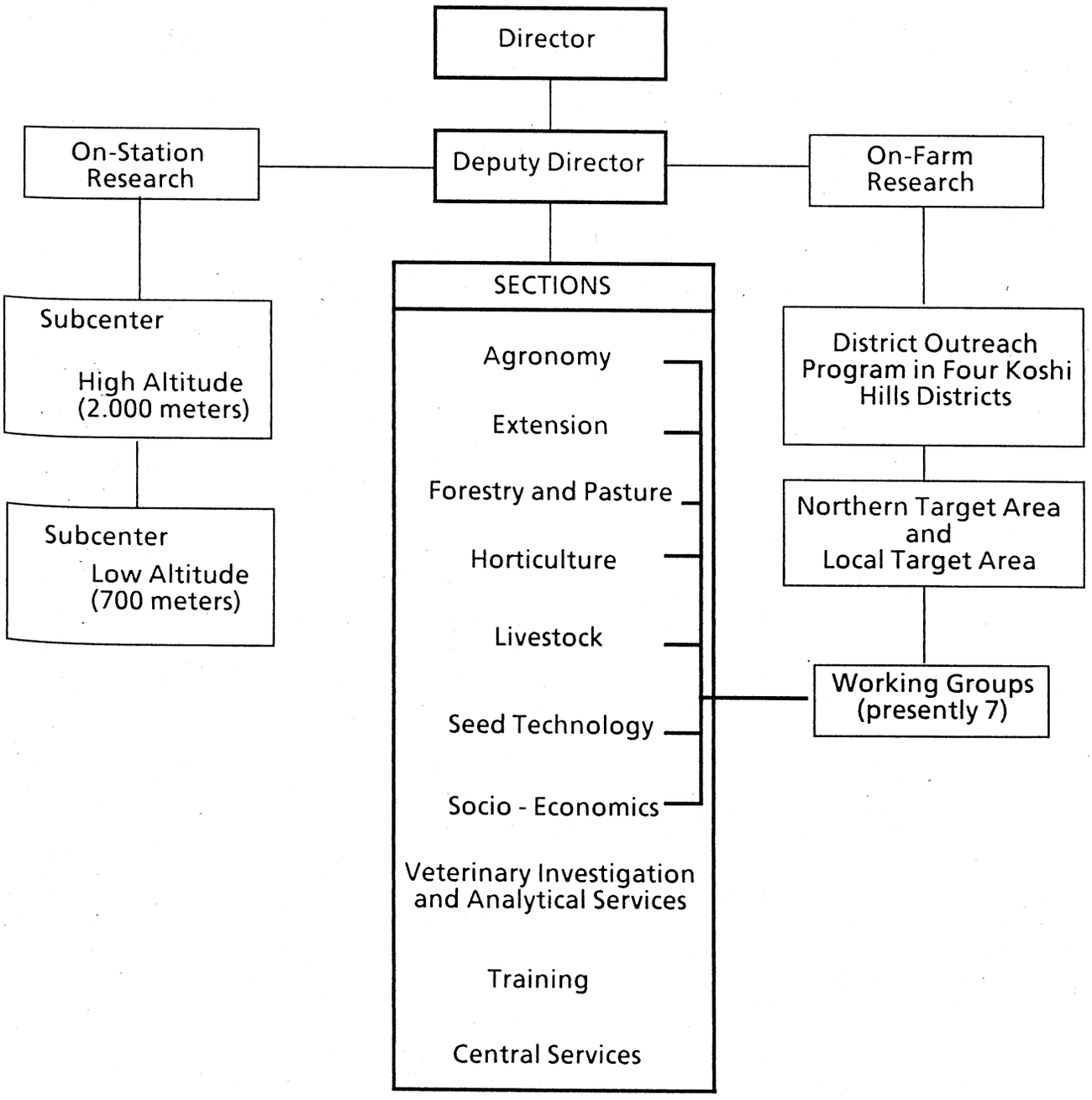
Testing and verifying the technological recommendations developed in the northern and local target areas within this new research command area has meant that the center has had to develop a new methodology for an enlarged field testing program. In 1983, Pakhribas implemented an outreach program in each of the four districts using a newly created on-farm research unit within the center's agronomy section.

To support the OFCOR program, which now includes areas outside the agro-ecological limits of the center-based research programs, two research subcenters have been established to test and adapt technologies for higher and lower altitudes. At present, the on-station research program has the capability to test and adapt new crop technologies for high (>2300m), medium (1100-2300m) and low (<1100m) altitudes. Technology from this expanded program is further verified in the district outreach program and then recommended to the government extension program based in the district agricultural development offices.

Internal Organization of OFCOR

On-farm trials are planned, designed and implemented by the agronomy section. The organization of on-station and on-farm research is shown in Chart 12. On-farm research is directly linked to the on-station research program through the senior on-farm research agronomist and the chief agronomist (section head).

Chart 12: Organizational Structure of Pakhribas Agricultural Centre



Source: PAC, 1988.

Development and Management of Human Resources.

Profile of staff. Pakhribas Agricultural Center employs more than 350 people as scientists, technicians, clerks and laborers. In 1988, there was a total of 52 scientists working in the nine technical sections, nine of whom (17%) were working in the agronomy section. All OFCOR staff are based in the agronomy section, and six (66%) of the nine scientists in that section are engaged full-time in OFCOR activities. In addition to the scientists working in the agronomy section, there are 28 technicians, 19 of whom (68%) are engaged in OFCOR work on a full-time basis (Table 23). A detailed profile of the OFCOR staff is shown in Table 24.

Table 23: Agronomy Section Staff at Pakhribas Agricultural Center (1987)

Position	Total	OSR	OFCOR
Scientists	9	3	6
Technicians	28	9	19
Total	37	12	25

Source: Pakhribas Agricultural Center, 1988.

Recruitment mechanisms. Recruitment mechanisms for senior staff are similar to those at Lumle Agricultural Center; however, the emphasis on recruiting government staff on deputation has been somewhat less. The majority of the staff at Pakhribas have been hired directly from advertised positions through open competition. Overall, they are much younger and have less working experience than the staff at Lumle. The center at Pakhribas has maintained a recruitment policy of hiring staff from the Hill Region who have experience in Hill agriculture. There have been no difficulties in recruiting the necessary staff for its programs and the center, being funded by ODA, pays staff salaries that are two to three times greater than comparable government salaries. It also provides a much better benefits package along with academic training opportunities. These practices have allowed Pakhribas to develop a highly competent core of on-station and on-farm researchers as well as technical staff to support the research programs.

Technical staff are hired locally and receive in-service training twice a year at the center through the training section. This keeps the technical staff up to date with new OFCOR technology and methodology. The training is multidisciplinary and senior research staff from all sections participate in the courses. Unlike government service technical staff whose work performance is unsatisfactory are dismissed. Of the 12 field assistants hired in 1983 for the outreach program, 9 have been replaced. The district agronomists received initial training from the agronomy section staff and toured many of the Cropping Systems Program sites prior to beginning work at their own sites in the outreach program.

Table 24: Profile of On-Farm Research Staff at the Pakhribas Agricultural Center (1987)

Position	Gender Male/ Female	Age	National/ Expatriate	Salary level per month (Rs.)	Educational level	Experience in Agriculture (Years)	Experience in OFR (Years)
Research Scientists:							
Senior Agronomist	M	NK	National	6724	MSc Ag	5	4
District Agronomist	M	28	National	5200	MSc Ag	5	2
District Agronomist	M	29	National	5200	BSc Ag	5	2
District Agronomist	M	28	National	5200	BSc Ag	5	2
District Agronomist	M	29	National	5200	BSc Ag	5	2
Superintendent	M	NK	National	2850	BSc Ag	NK	NK
Technicians:							
Superintendent (5)	M	NK	National	NK	6th Class pass to ISc Ag	1-8 years	1-2 years
Field Assistants (14)	M	NK	National	NK	5th Class pass to high school Certificate	local farmers	1-2 years

Notes: US$ 1 = Rs. 21.90.
NK = Not known.
Age and salary levels are estimated.

Methodologies Adopted to Implement OFCOR

Site selection. The overall objective of the outreach program is to produce recommendations for improved crop technology which are of immediate relevance to the majority of farmers in the Koshi Hills area. To implement the OFCOR program in 1983, the center worked together with the KHARDEP Project to select representative sites within the new research command area using the methodology of the Cropping Systems Program.

Under the KHARDEP Project, three agricultural service centers have been constructed in each of the four districts. Each center has a command area of four to seven panchayats, and in each area, one panchayat (which was determined to be the most representative of that area) was selected for an outreach OFCOR site. These representative panchayats were then subjected to site description surveys using secondary data and key informant farmer surveys to provide background information on resources, infrastructure, institutions and the most common cropping patterns. These cropping patterns were then selected for on-farm verification trials.

In 1985, Pakhribas Agricultural Center adopted the concept of recommendation domains, which is helping to further define and establish research priorities at the OFCOR program sites, e.g., some domains are more important than others. The socio-economic section has taken the lead role in the development and refinement of these recommendation domains by conducting intensive surveys throughout the research command area. Using surveys to monitor the adoption of recommended varieties and practices has also provided information which has helped focus the center's research programs in the technical sections as well as giving more information for the redefinition of the recommendation domains, which is a continuing process.

On-farm research trials are now designed for the three altitude areas (high, medium and low) and three land types (upland, lowland irrigated and lowland rainfed) using the common cropping patterns. As each OFCOR site consists of a number of different recommendation domains, research staff have focussed on producing recommendations for the farmer clients within those particular domains. As more information and experience is gathered from the OFCOR sites, the recommendation domains are being constantly re-evaluated and redefined.

Trial methodology. Pakhribas uses the same type of trials as described for Lumle. These include farmer field trials, pre-production verification trials and minikits. Inputs for the trials are provided by the center either from their own material or from material received from the national commodity programs. Most of the trials implemented are farmer managed with guidance from the district agronomists and superintendents. In 1987, Pakhribas conducted 88 farmer field trials and 19 pre-production verification trials as part of the outreach program. Similarly, 450 summer minikits (rice and millet) and 356 winter minikits (wheat and maize) were distributed in the outreach area. Farmer feedback on the performance of the minikits averaged over 50%, much higher than the feedback percentage for the national commodity programs.

Researchers at the center have, however, been acutely aware of the need to develop trial methodologies that are appropriate to the needs of the farmers within their research command areas. Over the years, Pakhribas has modified several of the popular trial methodologies used in Nepal to provide them with more accurate and better information. The pre-production verification trial, which was introduced by the Cropping Systems Program, originally was designed to test new improved varieties and practice as a "package" with a local variety. Pakhribas staff have modified this into a diamond trial design which splits the improved package into two components. The pre-production verification trial, using a test plot of 125 meters^2, can now provide information on local versus improved packages, local versus improved varieties, local versus improved husbandry practices, and the interaction effect between variety and husbandry. Despite the slightly increased cost of this more complex research design and research input (labor, supervision and financial resources), the diamond trial design provides much more information on the performance of improved crop technologies. Using this information, Pakhribas staff have been able to achieve greater precision in their trials and have been able to "unbundle" the packages of technology coming from the national programs into recommendations more appropriate for their clients.

Minikits, which are produced at Pakhribas using their materials, have been modified to include two varieties for testing by the farmer (either two improved varieties or one improved and one superior local variety) rather than the single variety (using only improved material) in the kits distributed by the national commodity programs. This has put the Pakhribas minikit program into more of a research mode and utilizes the farmer as a research partner. District outreach staff monitor the minikits with the government's extension staff. Results from the minikits are an important source of information in the planning and programming process at Pakhribas.

Working groups. Unlike Lumle Agricultural Center, which has moved to an integrated farming systems-based OFCOR program, the OFCOR program at Pakhribas is still primarily based on cropping systems. Moves are now underway to implement a wider farming-systems approach. The first step has been to develop "cross-section" working groups similar to Lumle's "thrust approach" to deal with problems that have been identified in the field and which involve more than one section (Chart 13).

At present, seven working groups have been organized. A farming systems working group is examining the different methods and problems of developing an appropriate farming systems program while a sustainable technology group is working on the development of low-cost, low-input technology suitable to the socio-economic conditions of the eastern Hills. Other working groups are dealing with problems in soil fertility: conservation, management and improvement; fodder production, management and utilization; information dissemination; research and extension methodologies; and the participation of women in development. These working groups are the first step toward developing an integrated farming systems approach and have been successful in bringing different research staff together in an interdisciplinary setting.

Chart 13: Working Groups at Pakhribas Agricultural Center

Working Group	Sections Involved	Primary Objective
1. Farming Systems	All	To provide essential linkages between research, extension and service activities in the Koshi Hills.
2. Soil Fertility	Agronomy Forestry Livestock	To develop systems of management of soils and biomass that maintain the stability and productivity of the resource base in the Koshi Hills.
3. Fodder Production	Livestock Forestry VIASS Agronomy	To improve the quantity and quality of fodder to farms and to develop efficient systems of fodder management & utilization.
4. Women's Participation in Development	Extension Horticulture Livestock Socio-Eco.	To develop, jointly with women's groups, technologies appropriate to the needs of women in farming households.
5. Sustainable Technology	Agronomy Seed Tech. VIAS Horticulture	To develop sustainable systems of resource development that rely minimally on the importation of nonrenewable resources.
6. Research and Extension Methods	All	To develop appropriate research and extension methodologies for the development of farming in the Koshi Hills.
7. Information Dissemination	All	To publicize and inform a range of clients about the activities and results of Pakhribas Agricultural Center's work.

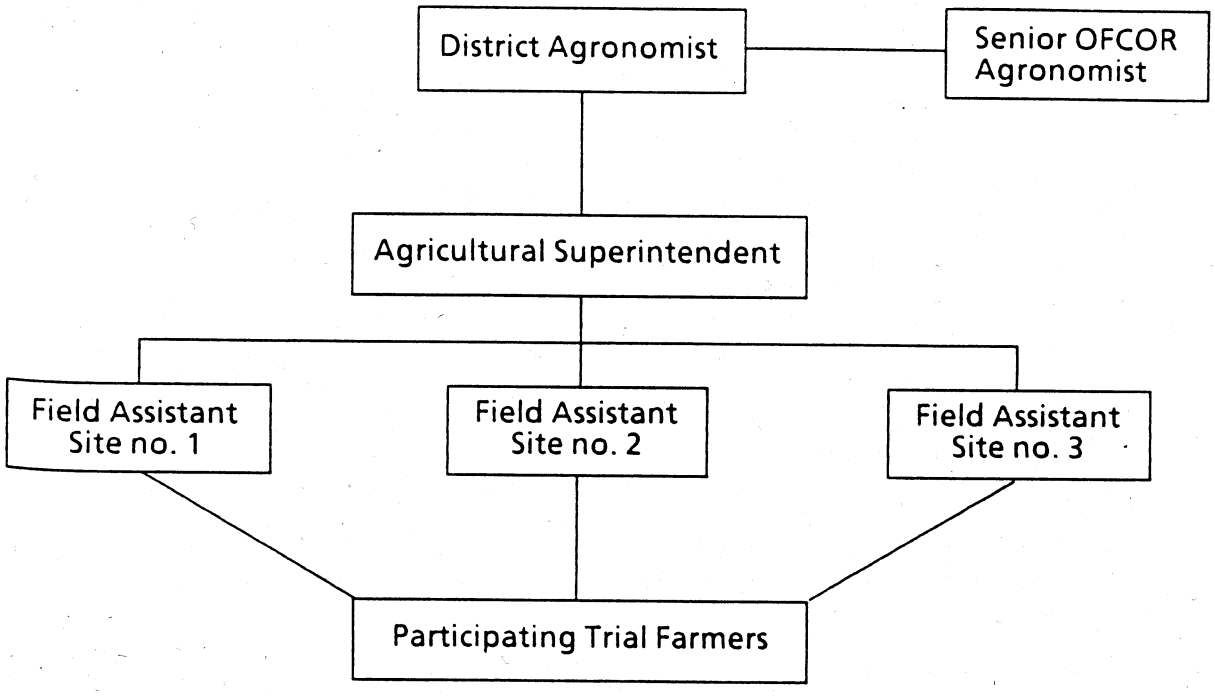
Source: Pakhribas Agricultural Center, 1988.

Management of OFCOR

Management and supervision of field operations. On-farm research field teams are located in each of the four districts served by the outreach program. Each team consists of an agronomist, a superintendent and three field assistants. The district organization is shown in Chart 14.

The administration and supervision of the outreach program is the responsibility of the agronomy section, and one senior agronomist

Chart 14: OFCOR Organization at the District Level



based at the center is assigned to look after OFCOR activities. He supervises the district-based OFCOR teams through frequent visits and coordinates with the other center sections in providing technical/material support for OFCOR trials. The chief and senior on-farm research agronomists report field activities to a technical committee meeting that is held monthly at the center and is attended by all section heads and senior research staff.

The district agronomists are based in the district agricultural development offices in each of the four districts but spend 50% of their time in the field managing on-farm trials and collecting trial data. They are responsible for selecting the trial sites in each panchayat with the assistance of the superintendent and the field assistant. During the cropping season the district agronomists visit each site at least three to four times during the time of trial layout and planting, tillering/flowering, and harvest. They also visit individual trial sites if requested to do so by the superintendent or field assistant. District agronomists file a trek report with the senior on-farm research agronomist at the center whenever they travel in the field. District agronomists do not normally attend the monthly technical meetings at the center unless they are in the center at the time the meeting is being held.

When not in the field, the district agronomists and superintendents participate in many of the District Agricultural Development Office activities including the monthly office meetings with extension staff and training programs. Results from field trials and subsequent extension recommendations are discussed in detail with the agricultural development officers and extension staff along with new research ideas coming from Pakhribas Agricultural Center or from the extension staff in the field.

The field assistants, who are locally hired farmers from the trial sites, are based at each of the three OFCOR sites in each district and are responsible for the selection of participating trial farmers and the daily management of the trials, including the recording of basic data. They receive training in a multidisciplinary mode from Pakhribas through the "in-service" training program and are totally research oriented (everyday extension responsibilities are provided by the government's extension agents assigned to the area by the district agricultural development office). Each field assistant is required to submit fortnightly and monthly reports of his activities at the site to the senior on-farm research agronomist at the center. These reports are used to monitor the field assistant's performance and to alert the Center staff of any difficulties with the trial programs.

The superintendent acts as the link between the field assistants and the district agronomist by carrying instructions to the field assistants and reporting back to the district agronomist on field activities. The superintendents are senior technical staff and receive "in-service" training twice a year. They report to the district agronomist and file a report with the senior on-farm research agronomist at the center after every tour to the field sites.

Planning, programing and review mechanisms. The annual planning, programing and review of OFCOR trials is a joint exercise between on-station research staff and OFCOR staff. Several different methods are involved. For agronomic trials, the district agronomists are called to the center to participate in planning and review sessions with the agronomy section for the next cropping seasons trials. These planning sessions are held twice a year for each cropping season (summer and winter). New technology available from on-station research, both from Pakhribas Agricultural Center and the national programs, is reviewed with the OFCOR staff in relation to previous trial results as well as new problems and constraints encountered in the field. New trial proposals are developed which include a detailed assessment of required inputs, manpower and number of sites for implementation, along with a budget for each trial. These are then submitted to a technical committee for screening and review.

The technical committee meets monthly at the center and is comprised of all the section heads. The primary function of the technical committee is to review the center's overall program. Sections report on-going activities and present proposals for new research trials. Regional and district-based government staff are also invited to comment on research proposals. This protocol system is applied to all trials for all sections and working groups, both on and off station, and ensures that the work of the sections is in line with the research priorities of the center. Trials that are approved by the technical committee are also sent to the National Agricultural Research and Services Center's technical panels for review. It is interesting to note that the NARSC's system of research trial review has been adapted from Pakhribas Agricultural Center's system.

Samuhik bhramans are also a valuable tool in the planning and programing process. Unlike Lumle, Pakhribas has not regularized the

use of the samuhik bhraman, partly because of the larger target area it has to cover and the time involved in samuhik bhramans. However, Pakhribas does use the samuhik bhraman to address key problem areas which are identified in the field. Since 1988, four samuhik bhramans have been organized at Pakhribas by different sections. The agronomy section has organized two, one each for wheat and potatoes. Research staff at Pakhribas, along with research staff from the national programs and local district and regional agricultural offices participated. The socio-economic section organized a samuhik bhraman in the high-altitude areas to gather information to assist in the development of appropriate recommendation domains. Likewise, the extension section has organized a samuhik bhraman in the northern target area to examine current extension methodologies and their effectiveness. Unlike the Farming Systems Research and Development Division, Pakhribas pays all the costs for outside participants from the government and has had very good participation from scientists at the national commodity and disciplinary divisions.

Management of farmer collaboration. Using recommendation domains to select OFCOR trial sites, four to five farmers are selected by the locally hired field assistants to cooperate in the OFCOR trials. The criteria used by the field assistants to select farmers include the following: 1) they should be representative of other farmers in the area (in regard to resources, cultural practices, education and socio-economic standing, etc.); 2) they should have creditability within the community; 3) they should be willing to cooperate in testing the cropping patterns through an entire year; and 4) they should be located closely to one another for easy supervision and good demonstration effect.

Data analysis and dissemination of information. District agronomists and their superintendents collect field trial data and report this information to the senior agronomist at the center, where information from all outreach sites is compiled and analyzed by the agronomy section. Data from on-farm research trials are evaluated in terms of agronomic and economic criteria (partial budgeting and marginal returns) following the guidelines established by the Cropping Systems Program. This allows comparisons with trial data from other OFCOR programs. Results of the trials are published in technical papers which are presented to the technical committee and distributed to all sections. These reports are also presented by the agronomy section at the national-level crop and farming systems research working group meetings organized by NARSC as well as distributed widely to other development projects and government offices through the center's annual report. Like Lumle, Pakhribas has a good reputation for reporting the results of their OFCOR activities, and this information is in great demand by other programs and projects. Pakhribas encourages its staff to write articles related to their research or fields of interest and has a series of working and occasional papers. Many of these papers have been presented at international seminars and published in international journals.

The socio-economic section acts as a service section and carries out various socio-economic surveys, marketing studies, monitoring and evaluation of programs as well as special studies in collaboration with other sections. It also provides assistance and advice in the

design of surveys, and statistical and economic analysis of research data.

Organization and Management of Linkages and Information Flows

Within the national agricultural research system. Although Pakhribas is autonomous in its organization and management, it is technically integrated within the national government network of farms and stations under NARSC and is recognized as a regional testing center by the crop commodity programs. Pakhribas cooperates fully with the national commodity program's trials and reports results back through the national working groups and seminars. As a regional testing center, it not only participates in national-level evaluations, it also picks up varieties that perform well in its target areas and develops them for recommendation.

A recent example of this cooperation with the national programs was the release of a new maize variety, Manakamana-1, which was jointly developed by the research staff at Pakhribas and the national maize development program. Similar work is also being carried out for rice, wheat and potatoes.

The OFCOR program at Pakhribas has also played an important part in increasing the recognition by national researchers of the importance of minor crops in Hill farming systems. It identified a major cropping pattern in the hills based on a maize/millet relay which led to a number of trials involving time of planting and different varieties for both maize and millet over the past few years. This has been partly responsible for the establishment of a commodity program for Hill crops (millet, barley, amaranthus) by the government in 1986.

Within and between on-farm research programs. Pakhribas Agricultural Center has a strong linkage with the national Farming Systems Research and Development Division programs. It actively participates in the farming systems research working group meetings and has participated in the samuhik brahmans held at the FSRDD farming systems site at Khandbari which falls within the Pakhribas research command area. It also maintains very strong links with the work at Lumle Agricultural Center through frequent staff visits and personal relationships.

Farmers and research staff. The district agronomists visit on-farm trial participants at least once a month during the cropping season to hear from them how the trials are progressing. This information, representing the farmers' own impressions of the trial, is considered a vital part of the on-farm research planning process in addition to the standard trial measurements. During the agronomy section's bi-annual summer and winter crop planning and review sessions, this information is presented and discussed along with the trial data. One example of how this process has worked relates to a white-seeded improved maize variety (Janaki White) which was being extended to farmers in the research command area. Farmers were very happy with the yield but were unhappy with the poor quality of husk cover which affected the storage quality of this otherwise highly acceptable variety. The district agronomists picked up this information and the agronomy section began to screen this variety for better husk cover. The resulting material was put back into the

extension program and is now well liked by the farmers. A further dimension to this was the feedback to the National Maize Development Program. White-seeded maize varieties, which are popular only in the eastern region, have received low priority from the national maize breeders, yet the regional work by Pakhribas on improving this variety of maize has been recognized by the national breeders and is being promoted nationally.

The use of the samuhik brhaman supplements the process of collecting information on farmers' impressions and brings the combined OFCOR and station-based research staff into direct contact with participating farmers. As with the Farming Systems Research and Development Division, the district field staff organize farmer field days at the trial sites not only to demonstrate performance but to get a broader reaction to the work from other farmers. In a similar fashion, the district agricultural development officers and extension staff organize farmer tours within the district and take groups of farmers around to the various OFCOR trial sites.

Farmer experimenters and research staff. Pakhribas has recently launched a new program to encourage farmers who have been identified as "local experimenters" to do research themselves. The program evolved out of the experience of the OFCOR staff with farmers who have "modified" trials to better suit their particular needs. An example of this is the modification that some experimenting farmers have made to the spacing recommendations of 60 cm by 20/25 cm for planting peas. Farmers found that at this spacing there was a lodging problem because it was uneconomical to provide pole supports. Farmers tried to intercrop the peas with maize using the same spacing recommendations but found that the maize stalks could not support the fruiting pea plant. Several experimenting farmers used different spacing patterns and soon found that the best spacing was 40 cm by 5 cm This is now the regular Pakhribas recommendation.

The program using farming experimenters as research partners involves providing these farmers with new crop varieties which have been proved beneficial through verification trials along with basic information as to the purpose of the program. The farmer then chooses the land and the cultural practice which he feels is best. The program is monitored during the cropping season to see how the farmer has adapted or modified the technology to fit into his cropping system. Pakhribas researchers hope to learn more about farmer practices and pick up new methodologies which may be superior. If the program is effective, it is believed that this methodology could make better use of scarce research resources as well as reduce the time required for the testing and verification of new technologies.

Extension agents and OFCOR staff. Although the district agronomists are based in the district agricultural development offices, which are responsible for the government extension program in the target areas, there is little formal contact between the government's extension staff and the center's staff. The contact that does exist is based on personal relationships that have been developed by the district agronomists. Pakhribas has recognized this as a serious constraint to its OFCOR program and is attempting to develop a formal relationship between the government's extension staff and its own field staff.

Experiment station and on-farm research staff. Since its inception, the on-station research program has always been directed at supporting the research and extension activities in the Pakhribas target areas, and now in the much larger research command area. Pakhribas Agricultural Center's mandate is to develop appropriate recommendations for all crop, horticultural, forestry and livestock activities in the Koshi Hills area. The technical sections at Pakhribas work on problems identified in the field by the OFCOR staff or staff from the extension section (limited to the northern and local target areas), either on an individual-section basis or through the newly established working groups. The emphasis at Pakhribas is on applied and adaptive research to develop solutions to these problems. As Pakhribas moves to a program oriented more towards farming systems research, the working groups are becoming the key link to the OFCOR program.

One example of where station-based research staff helped solve a problem identified in the field was the problem of brown rot in the improved potato (Kufri Jyoti) recommended by Pakhribas. In some pockets within the research command area the problem of brown rot was particularly severe. On-farm research staff brought this problem to the attention of the center in the annual program and planning meeting in 1985. Station research staff immediately recommended another variety that was brown rot resistant (BR-34), as a replacement. The agronomy section now regularly screens all new potato lines for brown rot resistance. Similarly, on-farm staff in high-altitude areas found that the same potato variety (Kufri Jyoti) was not being adopted by farmers in high-altitude areas. The district agronomists found that this particular variety had a slower recovery rate after being damaged by hail (which occurs regularly during the potato growing season) than the local varieties used in these areas. On-station research staff picked up this information and began to test new potato varieties for resistance to stress such as that caused by hail. The research program now conducts a subset of the normal potato trials in sites which are prone to hail damage.

Management of Financial Resources

Pakhribas Agricultural Center is wholly funded by the British Aid Program, and the management of financial resources is the same as that described for Lumle Agricultural Center. The total budget for 1987/88 was 962,000 Pounds Sterling (approximately 1.5 million US$). Though OFCOR activities at Pakhribas are not covered by a separate budget, the annual budget for the center is broken down into extension and research activities. In 1987 this breakdown was 61% for extension support services and 39% for research activities. An analysis of the research budget for each section indicates that approximately 56% of the research funds were spent on OFCOR (22% of the total center budget) while on-station research was 44% (17% of the total budget). In 1986/87, approximately 60% of the agronomy section's annual budget was spent on OFCOR, compared to around 50% in 1985/86.

ANALYSIS AND SYNTHESIS OF ORGANIZATION AND MANAGEMENT IN OFCOR CASE STUDIES

Strengths and Weaknesses of the Institutional Features of the Five Case Studies

In this section we examine the strengths and weaknesses of the different case study programs in relation to the ways in which they have been organized and managed. Information for the analysis has come from detailed interviews with senior and junior research staff members in all the case study programs, as well as technical staff and farmers involved in the OFCOR programs. The synthesis and interpretation of this information has been the group responsibility of the case study authors.

In the Nepal situation, the individual OFCOR case study programs have developed distinct management techniques and organizational forms as a result of their different program objectives (which in some cases have changed over time) and differential access to financial and human resources. These appear to be the key factors distinguishing the programs. For example, the National Rice Improvement Program at the Parwanipur Agricultural Station had as its original objective the national evaluation of exotic rice varieties (obtained mostly from IARCs) through multilocational on-farm testing. At the time, this did not reflect the current concept of on-farm client-oriented research. Through modifications of their program of farmer field trials, the program has, however, become more client-oriented. Their clients are now the research centers, stations and farms in the regions which are growing in importance as site-specific testing and development areas within the national research system. The part-time involvement of the Rice Improvement Program research staff in OFCOR activities, being that their major role was as breeders and agronomists for basic and applied experiment station research, resulted in very limited involvement in the actual implementation of the OFCOR program and a heavy reliance on other research staff at the outlying stations and farms to manage the program in farmers' fields. This lack of a well developed linkage between the trial designers and trial implementors limited the ability of the National Rice Improvement Program staff to get a better "client" orientation in their program. The recent implementation of an outreach research program in the periphery of the station has helped bring on-station researchers into greater contact with farmers by working with the outreach on-farm research staff. This has resulted in a better understanding of the farmers' problems and constraints, which is being reflected in the redesigning of many of the farmer field trials.

The OFCOR programs at Pakhribas and Lumle Agricultural Centers, on the other hand, evolved out of very strong training and extension programs which were being implemented in small, well-defined target areas. These programs, originally supported by on-station multidisciplinary adaptive research programs, moved to a program based more on investigative, applied and adaptive research to meet the needs of their farmer clientele. As such, the OFCOR programs developed from within an already well-established multidisciplinary, client-oriented program. This had a major influence on the way the OFCOR program was developed.

The Cropping Systems Program and Farming Systems Research and Development Division evolved somewhat differently and have taken more of a middle ground between the programs of the National Rice Improvement Program and the Pakhribas and Lumle Agricultural Centers. Their initial development was primarily based on the perceived need (by Nepalese policymakers and visiting international research scientists) to get the technology being developed by the national research program out to the farmers. As such, these programs were more the "pushing out" of existing agricultural technologies for demonstration and verification under farmers' conditions using an integrated systems methodology. Consequently, programs such as the Cropping Systems Program, though being client oriented, were working with farmers who could adopt the existing technologies which, by their nature, were heavily biased to the resource-rich, irrigated conditions of the Tarai. It has only been in the last few years that technologies appropriate for rainfed, upland conditions, which are predominant in the country, have come out of the domestic breeding programs. Emphasis is just now being directed at the development of low-input, low-cost, sustainable technologies appropriate for the majority of farmers in Nepal.

Tables 25, 26, and 27 provide a summary of the major strengths and weaknesses of the institutional features of the case study programs. These are discussed in greater detail in the following sections.

Development and Management of Human Resources

The development of competent and experienced on-farm research staff has been a critical problem for some of the case study programs, especially those that are bound by government civil service regulations and bureaucracy. One of the major factors has been recruitment policies (discussed below). However, the issues of career advancement, staff salaries and benefits, especially for OFCOR teams assigned to remote, rural areas or for research scientists who are expected to travel to these areas to implement, monitor and supervise field activities, have also been important factors. Career advancement is not necessarily linked to ones present program; consequently, many staff members who are promoted must leave to take up positions in other programs and offices. For example, a III class socio-economist involved in an OFCOR program may be promoted but this may involve taking a position within the National Planning Commission or in the Department of Food and Agricultural Marketing Services. This limits the impact of training for special positions such as those involved in OFCOR programs.

Recruitment Mechanisms. Permanent positions (postings) for OFCOR staff have been difficult to obtain for the outreach program at the Parwanipur Agricultural Station and the Farming Systems Research and Development Division, as well as the Socio-Economic Research and Extension Division. Many of the senior-level staff assigned to these OFCOR programs have been on deputation or on temporary assignment from other disciplines and offices. While on deputation or temporary assignment, these staff members are still ultimately responsible to their home office, and their career paths are within their home programs rather than the program in which they are temporarily serving. Other staff members have been hired on a project-temporary basis through a supporting donor project. These

Table 25: Summary of the Institutional Features of Parwanipur Agricultural Station

Institutional Feature	Related OFR Approach or Technique	Strengths	Weaknesses
1. PAS/NRIP funded and administered by HMG/N through NARSC of the Ministry of Agriculture	National-level OFR trials using Farmer Field Trials (FFTs) and "minikits"	a. Sets national priorities b. Influences national research c. Develops technology for different agro-ecological regions d. Attempts to identify and utilize experimenter farmers	a. Poorly monitored b. Focus is more on distribution and less on feedback c. Inability to meet "minikits" objective, specifically to reach remote hill areas
This leads to: a. HMG/N salaries	------	See following points:	Low salaries make it difficult to survive on HMG/N salary alone
b. HMG/N Perquisites	------	a. HMG/N retirement system b. HMG/N provident fund c. HMG/N family health benefits	The point system for career advancement is not commensurate with field activities
c. HMG/N per diem (TADA)	------	Remote salaries provide incentives for remote area work	Per diems are lower than the daily survival requirements
d. Program continuity	Training provided to extension staff for implementation of trials	a. Permanency of institution means OFR program continues as it is	a. Lack of incentives to researchers and implementors causes poor performance
e. Dependent management	Major actions/decisions require approval of NARSC and relevant divisions	Quick agreement can be reached between relevant divisions and interdepartmental decision makers	a. Slows down decision making b. Historically: departments have no tradition of working together
f. Training	Training provided through donor agencies/projects. NARSC training program yet to be operationalized	Only perquisite for Nepalese staff	a. Patronage makes merit-based training nominations difficult b. Official approval process can be very slow
g. Multidisciplinary	Integration of biological scientists	Links commodity program with disciplinary units	a. Lacks input from social scientists b. Recommended technologies have often been socially unacceptable and uneconomic
2. Outreach program is administered by PAS under guidance from NARSC and funded by the Agriculture Extension Research Project	Outreach activities in periphery of station	a. Makes NRIP on-station technology available for testing in local target area under guidance of station staff b. Outreach program brings station staff in contact with local farmers and extension staff	a. Implemented by junior technicians without incentives or guidance b. Outreach researchers are very junior staff and hired on temporary basis c. Nonrenewal of AERP would imply a decline of affordable activities in outreach program
Dual work base: at PAS and in outreach sites	OFR staff visit field sites Extension staff are field-based	Decisions taken at PAS are easier to coordinate	Field visits by NRIP Research staff are irregular due to low per diem

Source: No-Frills, 1987.

Table 26: Summary of the Institutional Features of the Farming Systems Research Development Division

Institutional Feature	Related OFR Approach or Technique	Strengths	Weaknesses
1. Funded and administrated by HMG/N through NARSC of the Ministry of Agriculture	Through FSRDD, multidisciplinary farm field-based with explicit feedback to crop commodity programs.	a. Sets FSR field priorities b. Influences the national	Hard to recruit and retain quality staff.
This leads to:			
a. HMG/N salaries	———	See following points:	Low salaries make it difficult to survive on HMG/N salary alone.
b. HMG/N perquisites	———	a. HMG/N retirement system b. HMG/N provident fund c. HMG/N family health benefits	The point system for career advancement is not commensurate with field activities.
c. HMG/N per diem	———	Remote salaries provide incentives for remote area work.	Per diems are lower than the daily survival requirements.
d. Program Continuity	FSRDD trains and supports national commodity outreach staff in FSR methods through samuhik bhraman.	If FSRDD/SERED divisions are fully institutionalized, this will be permanent.	a. Uncertainty of continuity leads to staff unease. b. Nonrenewal of ARPP would imply a decline of affordable activities.
e. Dependent Management	Major actions/decisions require approval of NARSC and relevant divisions.	Quick agreement can be reached between relevant divisions and interdepartmental decision makers	a. Slows down decision making. b. Historically: departments have no tradition of working together.
f. Training	Arrangements through ARPP for life of project. To be based on merit and hard work.	Only perquisite for Nepalese staff.	a. Patronage makes merit-based training nominations difficult. b. Official approval process can be very slow.
g. Multidisciplinary	FSR approach represents first time for official collaboration between crops, livestock and forestry	Integrates livestock and forestry aspects into systems research from the beginning	The decision-making process is slowed down at the beginning
2. Dual work base: in center and FSR sites	Site coordinators are field-based while sites monitors and other technical staff are center-based	Center decisions are easier to coordinate	It is difficult for center-based staff to receive economically viable salaries

Source: Galt, 1987.

Table 27: Summary of the Institutional Features of the Lumle and Pakhribas Agricultural Centers

Institutional Feature	Related OFR Approach or Technique	Strengths	Weaknesses
1. Independently funded and adminstered	———	Can implement FSR somewhat independently of HMG/N ideas on	Project is not directly replicable by HMG/N
This allows: a. Higher staff salaries	———	a. Attracts more competent staff b. Staff more willing to live and work in remote areas	Low replicability to HMG/N
b. Higher field allowances	Samuhik bhraman/Trekking	a. Much easier for staff to go to field b. Direct reward for getting close to farmers	Low replicability to HMG/N
c. Continuity of project	LAC/PAC can address longer-term research problems (e.g., declining soil fertility). Time to adopt and evolve FSR approach from experience	a. Higher staff commitment to FSR b. Retain highly experienced staff with Hill experience	a. Pressure to "hand over" to HMG/N b. Possibility of project becoming "stale" (staff inertia)
d. Independent management (not a part of HMG/N)	Multidisciplinary approach: inclusion of crop, livestock, forestry and socio-economists in research planning and implementation	a. Teamwork easier b. Flexible policy on staff development, responsibilities, etc. c. Can fire ineffective field staff d. Informal coordination is easy (more useful than formal?)	a. Formal coordination at national level may be difficult b. Difficulty in getting results and and recommendations accepted at national level
e. Ease of providing training	a. Send off staff on FSR short-course training programs b. Select longer-term training with FSR input	a. Increases motivation b. Training opportunities (esp. MSc level) attract competent staff	Jealousy between HMG/N and LAC/PAC regarding training opportunities
2. Based in regions and remote areas	Geographic mandate/command	a. Limits responsibility to extrapolate results beyond command areas b. Ease of implementing samuhik bhraman/RRA and on-farm trials c. Immediate focus on rural areas and farmers d. Small size makes Team work and multidisciplinary research easier.	a. Recruitment disincentives b. Difficult to get top HMG/N decision makers to visit sites/ stations regarding acceptance of of results and FSR methodology

Source: Galt, 1987.

staffing practices have not allowed the development of a cadre of career-oriented OFCOR scientists and supporting technicians within these programs. The one exception to this has been the use of HMG/N staff on deputation at Lumle, but under the provision of Lumle's higher salaries and staff benefits, which include the opportunity for higher postgraduate training in OFCOR-related subjects. Many of Lumle's HMG/N staff have been on deputation for more than 10 years.

In OFCOR programs where donor funding has been a major source of support for implementing activities (i.e., the Outreach Program at Parwanipur Agricultural Station and the Cropping Systems Program), the solution has been to hire, for the period of the project, sufficient staff to facilitate the operation of the program. However, this has led to problems of continuity, as staff often leave once they are offered a permanent position elsewhere. There are also problems of sustainability once donor support is withdrawn, as was the case of the Cropping Systems Program. Training programs also suffer as the "temporary staff" are often not allowed to participate in out-of-country training courses. Table 28 compares the OFCOR staffing policies of the different case study programs.

Table 28: Comparison of Staffing Situation of OFCOR Case Study Programs, 1987

Case Study	PAS Outreach Program	CSP	FSRDD and SERED	LAC	PAC
Staff Assignments:					
Permanent:[a]	1	3	21[b]	16[c]	25
Temporary:[d]	2	6	14	-	
Project staff:	-	18	17	-	-
Total	3	27	52	16	25
Of which:					
Full time:	2	27	52	6	25
Part time:	1	-	-	10	-
OFCOR Team located in a separate unit:	Mixed	Yes	Yes	No	Yes

Notes: (a) Permanent means permanent HMG/N staff.
(b) These staff are permanent HMG/N employees but on deputation (temporary assignment) to FSRDD and SERED from other offices.
(c) Includes 7 staff on deputation from HMG/N.
(d) Temporary means staff hired for temporary HMG/N service.

Internal Organization of OFCOR

OFCOR teams within the case studies have been organized in several different ways. The two OFCOR teams at Parwanipur (the National

Rice Improvement Program and the Research Outreach Program) have been organized differently. The National Rice Improvement Program team was composed of part-time station-based research staff. Their commitment to on-farm research activities was specified to be 40% of their time but there was no exact control over this. Since they were primarily involved in basic and adaptive research at the station, they were unable to become fully involved in the actual implementation of the farmer field trials; responsibility for implementation was given to research staff at outlying farms and stations and extension staff in the districts where the trials were carried out. The outreach staff, on the other hand, were posted as a separate group (hired temporarily for the duration of the project) within the Parwanipur Agricultural Station and funded by budget provisions from the Agriculture Extension and Research Project. Though there were good mechanisms for bringing the two groups together for joint discussions and planning (bi-monthly and semi-annual meetings), there was always a degree of animosity between them over differences in benefits, salaries and logistical support which favored the outreach staff, who were supported by project funds.

The Cropping Systems Program headquarters staff (senior researchers and socio-economists) were located in the Agronomy Division and supported by the Integrated Cereals Project. Field teams were based at the cropping systems sites. Center staff visited the field sites regularly but it was often necessary for the site coordinator to come to the center to secure trial inputs or to solve administrative problems. Being located in the Agronomy Division tended to give the Cropping Systems Program a lower status than the commodity programs with which they were working. In many ways, this resulted in the program being "marginalized".

The upgrading of the Cropping Systems Program into the Farming Systems Research and Development Division and its institutionalization within the national agricultural research system has not accorded the program with much more status. In fact, having division status has tended to limit the amount of coordination and cooperation that the Farming Systems Research and Development Division has been able to obtain from the other programs. Technical supporting staff from the commodity and disciplinary programs have not yet been identified, and this has limited the effectiveness of the farming systems program. The basic organization of the division is similar to the Cropping Systems Program, with a central staff of senior researchers supporting a field-based team at the research sites. However, FSRDD also has created a site liaison officer, called a site monitor, who is responsible for two sites and visits them on a regular basis. This has allowed the site coordinators to remain at the sites and supervise the site activities.

At Lumle Agricultural Center, researchers conduct both on-farm and station-based research. This model has been very effective in integrating on-station research and OFCOR. The samuhik bhramans, thrust groups and monthly technical meetings have been used to create an interdisciplinary approach for all OFCOR activities. As the target area has expanded, especially as a result of the agreement with the Hill Food Project, the research staff have found it more difficult to handle both on-station and on-farm research.

Lumle may have to establish a separate group to maintain its present commitments to OFCOR work.

Pakhribas Agricultural Center has established its OFCOR group within the agronomy section where it is led by a senior agronomist who reports to the section head. Other than the senior OFCOR agronomist, all other OFCOR staff are based in the outreach districts where they are supported by field staff. The OFCOR group is linked to the other sections through participation in an annual work-plan meeting, bi-annual working group meetings and monthly technical meetings. These meetings have proved to be very effective in getting information from the field-based programs regarding farmers' problems and constraints into the station-based research programs.

The small size and regional mandates of both Lumle and Pakhribas Agricultural Centers have facilitated an interdisciplinary research approach and strong integration of research conducted on farm with that carried out on station.

Methodologies Adopted to Implement OFCOR.

Throughout the case studies there has been a high degree of commonality in the methodologies used to implement individual OFCOR programs. The methodology developed and used by the Cropping Systems Program (derived from the Asian Cropping Systems Network) was instrumental in influencing the methodologies of the other case study programs, especially those at the Lumle and Pakhribas Agricultural Centers, in addition to other donor-funded agricultural development projects. For staff at Lumle and Pakhribas, as well as for some of the staff from the outreach programs conducted at the agricultural stations, the Cropping Systems Program provided training (i.e., district agronomists and outreach staff at Pakhribas Agricultural Center and senior researchers at Lumle Agricultural Center). All research staff in the case study programs had visited the Cropping Systems Program sites. Table 29 shows the analysis of the use of different OFCOR trial methods by the case study programs.

Table 29: Analysis of the Use of Different OFCOR Trial Methods

Case Study	Farmer Field Trial	Minikits	Cropping Patterns	Varietal Trials	Husbandry Trials	Other FSR
PAS	***	***	-	***	*	-
CSP	***	***	***	*	*	-
FSRDD	***	***	***	*	**	***
LAC	***	***	**	***	**	***
PAC	***	***	***	***	**	***

Notes: *** Strong adoption
** Medium adoption
* Weak adoption
- No adoption

Another factor that has led to the exchange of methodologies has been the interchange of ideas and research methods among the staff from the different programs, facilitated by the national workshops and working groups. The samuhik bhraman is an example of this. First developed at Lumle, the samuhik bhraman process was described in a paper presented at one of the national working groups. Both the Pakhribas Agricultural Center and the Farming Systems Research and Development Division picked up this idea, and under a mutual decision, the common name samuhik bhraman was agreed upon by all three programs. Each of the three programs has, however, utilized the samuhik bhraman in a different manner. These variations are the result of differences in resources, manpower and size of the target area.

At Lumle Agricultural Center, for example, the samuhik bhraman is carried out regularly twice a year as part of the research review and planning process. Since Lumle's target area is relatively small and all the farming systems sites are within one day's walk from the center, it has been able to involve all senior research staff.

On the other hand, the Farming Systems Research and Development Division, working with the Socio-Economic Research and Extension Division (which plans and coordinates the samuhik bhraman), tries to plan two samuhik bhramans at each of their farming systems sites every year. These play a key role in the prioritization of the trial programs and also in the research planning and review process. However, the Farming Systems Research and Development Division has not been able to get the commodity programs and disciplinary divisions to provide research staff for the trek. Since the Farming Systems Research and Development Division's sites are spread throughout the country, the treks require significant travel time and costs. Many research staff complain that the government travel allowances and per diems are insufficient to cover the cost of the trips; therefore, there is little incentive to participate. Likewise, for research staff based in Kathmandu who often have second jobs outside the regular office, the time committment required for the samuhik bhraman is often too great in purely economic terms. These factors have hindered the participation of research staff and have limited the effectiveness of this methodology for the Farming Systems Research and Development Division.

Pakhribas Agricultural Center has yet to regularize the samuhik bhraman, primarily because its target area is much larger than Lumle's. Pakhribas has, however, used their methodology to investigate particular problems that have been raised from the OFCOR activities in the field.

The Lumle and Pakhribas Agricultural Centers not only utilized the Cropping Systems Program methodology but modified it to make it more appropriate to their particular programs and objectives. One example of this is their modification of the pre-production verification trials using a diamond design enabling four-way testing of local and improved varieties and practices. This modification has allowed both programs to select the most appropriate technology, which in some cases has been local technology under improved practices. As this is more in line with the objectives of their programs, it allows them greater freedom to verify improved

technology with existing farmer practices. However, Pakhribas and Lumle have only been able to adopt this modification because of their greater resources and more skilled technical staff. The modification does entail a higher cost in terms of manpower, time and material inputs, which is beyond the present ability of the government programs to implement.

Socio-economists have also played a key role in developing methodologies and carrying out surveys to help in the implementation of many of the OFCOR programs. At Lumle Agricultural Center, the present socio-economic section evolved out of a planning unit and now has the responsibility for managing and coordinating the farming systems sites. Socio-economists have played an important role in selecting farming systems sites, monitoring research activities and evaluating the recommendations produced by the research programs. Earlier within the Cropping Systems Program and now in the Socio-Economic Research and Extension Division, the role of strong socio-economic input in the development and management of OFCOR programs was recognized from the beginning. For Pakhribas Agricultural Center, the socio-economic section, which was only established in 1984/85, has been playing an increasingly important role in the definition of recommendation domains which will help the development of more appropriate technologies for the clients in the Pakhribas research command area. It is difficult to assess whether the lack of socio-economic input into the Parwanipur Agricultural Station Outreach Program or National Rice Improvement Program has hindered their effectiveness. Many of the regional research programs, such as those at Pakhribas, Lumle, and the national Farming Systems Research and Development Division use inputs from the National Rice Improvement Program and conduct socio-economic analysis on these trials which is transmitted back to the National Rice Improvement Program. It can be argued that the increasing importance that is being given to the regional programs is changing the methodologies and planning of the commodity programs. This has been true in the modification of the National Rice Improvement Program's farmer field trial program.

Management of On-Farm Research

Organization of OFCOR has varied from separate units (as in the case of the Cropping Systems Program, Pakhribas Agricultural Center and the outreach program at Parwanipur Agricultural Station) to fully integrated on-farm and experiment station programs (as in the case of the Lumle Agricultural Center and the National Rice Improvement Program at Parwanipur). The Farming Systems Research and Development Division is divided into a center-based team located in Kathmandu and separate teams at the farming systems sites, with overall direction and management of the program from the center.

Management of field operations. Farmers, hired as field assistants, have played a key role in the management of field operations in all OFCOR case study programs (Table 30). In all cases, they are guided by staff based at the trial sites. The management and technical abilities of the site-based staff has varied between programs, from locally hired farmers used as field assistants to agronomists experienced in on-farm research. However, none of the case study programs have indicated that the local management of field

Table 30: Management of Field Operations

Case Study Program	Groups Responsible for Field Management
PAS/Outreach	Field operations managed by farmers with inputs supplied by PAS.
PAS/NRIP	Field operations managed by regional research and extension staff.
CSP	Field operations managed by site coordinators and farmers.
FSRDD	Field operations managed by site coordinators and farmers.
LAC	Field operations managed by LAC research staff with support from field assistants and farmers.
PAC	Field operations managed by PAC on-farm research staff with support from field assistants and farmers.

operations has been a constraint to the success of OFCOR activities as long as there is sufficient expertise available either in a supervisory or monitoring capacity.

OFCOR supervisory and reporting mechanisms. Table 31 contrasts the different types of personnel that have been used to implement, supervise and coordinate on-farm trials in the different case study programs. Supervision at the sites has been with scientists (with a BSc in either agriculture or extension) who have been coordinated from the center by senior research staff. Actual implementation of trials has been done either by extension staff (as in the case of the Parwanipur Rice Improvement and Outreach Programs) or by locally hired farmers (either casually employed or regular employees). The use of local farmers as field assistants has been particularly beneficial in the selection of collaborating farmers (as has been the case with the programs at Pakhribas, Lumle, the Cropping Systems Program and the Farming Systems Research and Development Division). All on-farm field staff have reported to the heads of the OFCOR programs who have overall responsibility for the supervison of the programs.

Planning, programing and review mechanisms. All case studies have implemented planning and programing procedures for on-farm research (Table 32). The involvement of OFCOR staff has in some situations been limited to center-based staff (as was the case in the Cropping Systems Program, Pakhribas Agricultural Center and to some extent in the Farming Systems Research and Development Division). Where field staff have been involved in planning, they have made important contributions to the programs that were developed. The field

Table 31: OFCOR Supervisory and Reporting Mechanisms

Coordination and Supervision	Programs/Institutes				
	PAS	CSP	FSRDD	LAC	PAC
Farmer Field Trials:					
Implemented by:	On-Station Research Staff	JT/JTAs	JT/JTAs	Field Assistants	Field Assistants
Supervised by:	Researchers	Site Coordinator	Site Monitor	Superintendents	District Agronomist
Coordinated by:	Commodity Coordinator	CSP Coordinator	Site Coordinator	Socio-Economists	Senior Agronomist
Reported to:	Commodity Coordinator	CSP Coordinator	FSRDD Chief	Sections at LAC	Agronomy Section at Center
Minikits:					
Implemented by:	JT/JTAs	JT/JTAs	Field Assistants	Field Assistants	Field Assistants/HMG Ext.
Supervised by:	Extension Staff	Site Coordinator	Site Coordinator	Superintendents	District Agronomist
Coordinated by:	Commodity Coordinator	CSP Coordinator	FSRDD Chief	Socio-Economists	Senior OFCOR Agronomist
Reported to:	National Seminars	CSP Coordinator	FSRDD Chief	Sections at LAC	Agronomy Section at Center
Outreach:					
Implemented by:	JT/JTAs	——	——	——	——
Supervised by:	Outreach Research Staff	——	——	——	——
Coordinated by:	On-Station Research Staff	——	——	——	——
Reported to:	On-Station Research Staff	——	——	——	——
Pattern Trials:					
Implemented by:	——	Field Assistants	Field Assistants	Field Assistants	Field Assistants
Supervised by:	——	Site Coordinator	Site Coordintor	Superintendents	District Agronomist
Coordinated by:	——	CSP Coordinator	Site Monitor	Socio-Economists	Senior OFCOR Agronomist
Reported to:	——	CSP Coordinator	FSRDD Chief	Sections at LAC	Agronomy Section at Center
Other Trials:					
Implemented by:	——	JT/JTAs and Field Assistants	Field Assistants	——	——
Supervised by:	——	Site Coordinator	Site Coordinator	——	——
Coordinated by:	——	CSP Coordinator	Site Coordinator	——	——
Reported to:	——	CSP Coordinator	FSRDD Chief	——	——

Note: 1) JT = Junior Technician.
JTA = Junior Technician Assistant.
Source: No-Frills, 1986.

experience of the staff at Pakhribas was particularly important in "fine tuning" their site selection procedures and in helping the socio-economic section develop and refine recommendation domains for trial design and testing.

Government programs have been hindered by a lack of flexibility in planning, as they are required to submit yearly plans in advance. This has limited their ability to change direction or to pick up on problems that may be identified while implementing the planned OFCOR program. Pakhribas Agricultural Center and Lumle Agricultural Center's use of monthly technical meetings, along with the

Table 32: Planning and Programing Mechanisms for OFCOR in Case Study Programs

Case Studies	Planning and Design	Program Implementation
PAS		
-FFT	NRIP research staff	Research staff
-Minikits	NRIP research staff	HMG/N extension staff
-Outreach	Outreach research and on-station staff	Outreach staff -SMSs, and JTs in district agricultural offices
CSP		
-FFT	CSP center agronomists	Site coordinators
-Cropping Patterns	CSP agronomists and Site coordinators	for all trials with assistance of site
-PPVTs	CSP agronomists	field staff
FSRDD		
-FFT	FSRDD center agronomists	Site coordinators
-Minikits	Site coordinators	for all trials with
-Cropping Patterns	and Site monitors	assistance of site field staff
-PPVTs		
LAC		
-FFT	Research staff-	Field assistants for
-Minikits	All sections	all trials with
-Cropping patterns		assistance from superintendents
-PPVTs		
PAC		
-FFT	OSR and OFCOR staff	District agronomists
-Minikits	for all trials	and field assistants
-Cropping Patterns		for all trials
-PPVTs		

Notes: 1) FFT = Farmer field trial
2) PPVT= Production program verification trial
Source: No-Frills, 1986.

the Parwanipur Agricultural Station Outreach Program's bi-monthly meetings have given these programs the ability to respond quickly to make necessary adjustments or additions to their OFCOR activities.

Data analysis and dissemination of information. All case study programs have made good use of the data derived from their OFCOR activities. Analysis in some cases has been limited to agronomic evaluation in programs which did not have any socio-economic input, as was the case at Parwanipur Agricultural Station. At Pakhribas Agricultural Center, the agronomy section carries out basic economic analysis on trial data (partial budgeting and marginal rate of return) but depends on the socio-economic section when more detailed economic analysis is required.

At the national level, dissemination of information in all cases has been at a minimum via published reports. Several of the case study programs, notably Lumle Agricultural Center, Pakhribas Agricultural Center and the Cropping Systems Program have developed papers which have been presented at international workshops. A summary of the different reporting and dissemination practices is shown in Table 33.

One critical factor that comes out of the case study programs is whether or not the data collected at the field sites should be returned to the sites so that they can be used there by either site staff or farmers. Site coordinators in the Cropping Systems Program often felt that the information being returned was less than what they had collected. Likewise, the government extension staff who implement the farmer field frials and pre-production verification trials have felt that they are not directly involved in the trials because they do not receive the results. As they do not see any benefit coming back to them for the work they do in implementing the trials for the other programs, they have lost interest in implementing these trials.

Organization and Management of Linkages and Information Flows

Within and between on-farm research programs. Linkages and flows of information between on-farm research programs has been very strong, as indicated by the methods that have been used (Table 34). All OFCOR programs have been in contact with each other, either through official meetings where OFCOR programs are discussed or through more informal methods such as visits to the various OFCOR programs. The use of national annual working group meetings for crops and farming systems research activities has been important in the sharing of ideas and methodologies between the different OFCOR groups.

Farmers and research staff. For most case study programs, methods to obtain information from farmers were developed and used to better plan and implement OFCOR activities. All case studies have made good use of farmer tours, field days, farmer training programs and research staff field visits. Only the on-station researchers in the National Rice Improvement Program had little contact with the farmers participating in their farmer field trials. Part of this was a consequence of the national nature of the program because it included many sites in remote, difficult-to-reach areas. It was also due to the inability of the researchers to travel out to trial sites for supervision as a result of budget limitations and commitments to research activities within the station.

Table 33: Data Analysis, Reporting, and Dissemination of Information

Case Study	Data Analysis	Reporting	Dissemination of Information
PAS			
-Farmer Field Trials	NRIP-at PAS	NRIP	National working groups, seminars and bulletins
-Minikits	NRIP-at PAS	NRIP	
-Outreach	Outreach Staff	Working Committee	
CSP			
-Farmer Field Trials	Site coordinator and CSP Socio-Economists	Agronomy Division	National working groups, seminars and reports
-Cropping Patterns			
FSRDD			
-Farmer Field Trials	Site coordinator and FSRDD Agronomists	FSRDD	National working groups, seminars and reports
-Minikits			
-Cropping Patterns			
LAC			
-Farmer Field Trials	Senior agronomist Socio-economist	LAC - All Sections	National working groups, seminars and reports
-Minikits			
PAC			
-Farmer Field Trials	Senior agronomist	PAC-Agronomy Section	National working groups, seminars and reports
-Minikits			

Source: No-Frills, 1986.

Having staff permanently based in the field and situated close to the trial sites has been very important in building strong linkages between farmers and OFCOR staff. The use of local farmers as field assistants in the Pakhribas and Lumle programs and having a district agronomist with Hill farming experience has also been important in the success of their programs. Similarly the use of cropping system methodology and testing cropping pattern trials has led to the development of close relationships between participating farmers and OFCOR staff.

The samuhik bhraman has also been an important means of learning more about farmers' problems, both on an individual basis and from a group/community standpoint. Likewise, socio-economic surveys to select farming/cropping system sites and other household and baseline surveys have been valuable sources of information and have helped natural scientists develop more appropriate technologies for their client groups. An assessment of the strength of these linkages is presented in Table 35.

Table 34: Linkages and Information Flows between OFCOR Programs

From	--	To	Means of Information Flow
PAS	to	CSP	PAS research staff visit CSP
PAS	to	LAC	Working group meetings, seminars and workshops in addition to visits
PAS	to	PAC	Working group meetings, seminars and workshops in addition to visits
PAS	to	FSRDD	PAS provides OFCOR inputs for FSR trials
CSP	to	LAC	OFCOR methodology and procedure exchange
CSP	to	PAC	OFCOR methodology and procedure exchange
CSP	to	PAS	Provide feedback on minikits and farmer field trials CSP Staff assist in training PAS outreach staff
FSRDD	to	LAC	Working group meetings
FSRDD	to	PAC	Working group meetings
FSRDD	to	PAS	Provide feedback on minikits and farmer field trials
PAC	to	LAC	Visits, meetings and exchange of materials and procedures
PAC	to	PAS	Provide feedback on Hill farmer field trials and minikits as well as results from Hill varietal screening trials
LAC	to	PAC	Visits, meetings and exchange of materials and procedures
LAC	to	PAS	Provide feedback on Hill farmer field trials and minikits as well as results from Hill varietal screening trials

Notes: PAS = Parwanipur Agricultural Station
CSP = Cropping Systems Program
LAC = Lumle Agricultural Center
PAC = Pakhribas Agricultural Center
FSRDD = Farming Systems Research and Development Division

Source: No-Frills, 1986.

Table 35: Linkage Analysis between Farmers and On-Farm Researchers

Method	PAS	CSP	FSRDD	LAC	PAC
Baseline survey	-	***	**	**	**
Site description report	-	***	**	**	**
Samuhik bhraman	-	-	***	***	***
Farmers' meetings	-	**	*	**	**
Farmer field days	**	**	**	**	**
Farmer tours	**	**	**	*	***
Farmer trainings	**	**	**	***	***
Research staff field visits	***[1]	***	***	***	***

Notes: *** Strong linkage.
** Medium linkage.
* Weak linkage.
- No linkage.
(1) PAS outreach program only.

Farmer experimenters and research staff. Recognition and utilization of farmer experimenters as an OFCOR resource has been limited in all case studies (Table 36). However, in 1988 Pakhribas Agricultural Center introduced a special program to identify farmer experimenters and is attempting to involve them in a newly designed research program as informal researchers. It is hoped that if this program is successful, the use of farmer experimenters could save scarce research resources and reduce the time required to verify and disseminate new technology to farmers in their target areas. The program, having just been started, is being closely monitored by the OFCOR staff.

Both Pakhribas and Lumle Agricultural Centers have recognized the work that local farmers over the decades have put into developing local varieties suitable to particular areas within their research command areas. New improved varieties are always tested against the best local variety. Pakhribas and Lumle's use of the modified pre-production verification trial also allows them to identify superior farmer practices and crop management techniques. As new technology appropriate for many of the Hill crops has yet to be developed, Pakhribas and Lumle have used local varieties and local farming practices in many of their recommendations. The National Rice Improvement Program at Parwanipur, on the other hand, has made good use of these local varieties in their breeding programs to develop more robust varieties suitable for the Hill areas. Some of these new varieties are just now coming on-stream.

Extension agents and research staff. Linkages between government extension agents and OFCOR staff have been minimal except in the case of the outreach program at Parwanipur Agricultural Station

Table 36: Recognition and Utilization of Farmer Knowledge as an OFCOR Resource

Method	PAS	CSP	FSRDD	LAC	PAC
Recognizing farmers' informal research by research staff	-	-	-	**	***
Utilization of farmer experimenters for consultation	-	-	-	-	*
Local varieties picked up by research staff	***[a]	-	-	***	***
Local varieties used for recommendation	***[b]	-	-	**	**
Local farming practices picked up by research staff	*	*	*	**	**

Notes: *** Strong emphasis.
** Medium emphasis.
* Weak emphasis.
- No emphasis.
(a) National germplasam collection program.
(b) Used in national breeding programs only.

which is part of a training and visit project (Table 37). One of the objectives of this project is to promote better cooperation between research staff and extension staff. The on-farm research programs at both Lumle and Pakhribas have been built around their own extension programs, which have operated independently of the government extension program. Both programs are now making concerted efforts to link their extension programs with the government program. Lumle Agricultural Center is now working with a training and visit project while Pakhribas is building up linkages with the district government extension programs through their district-based agronomists. In a similar fashion, the Cropping Systems Program, which relied on its site-based staff for carrying out research trials, did not develop any linkages with the government extension programs until sufficient recommendations had been developed from their OFCOR program and they were ready to launch large-scale production programs. The Farming Systems Research and Development Division is presently running in a similar fashion but has recognized the need for greater involvement of the local extension staff in their farming systems sites.

Experiment station research and OFCOR. Linkages between the various OFCOR programs and experiment station research programs have been

Table 37: Analysis of Linkages between Extension Agents and On-Farm Research Staff

Method	PAS	CSP	FSRDD	LAC	PAC
Research-Extension liaison officer	***	**	*	**	*
Extension staff conducting OFCOR	**	-	-	-	-
Extension staff visiting OFCOR sites	**	**	-	-	-
Training and visits by research staff to extension staff	***	**	-	**	**

Notes: *** Strong linkage.
** Medium linkage.
* Weak linkage.
- No linkage.

well developed but largely one way, from the station to the field. (Table 38). For the National Rice Improvement Program, Cropping Systems Program and Farming Systems Research and Development Division, the feedback of information to the commodity programs and disciplinary divisions has been good but has not resulted in major changes to station-based research priorities, except in a few isolated examples. For the Parwanipur Agricultural Station outreach program, there has been some evidence of action on feedback from the field research programs primarily because of the close involvement of the National Rice Improvement Program staff in the bi-monthly and semi-annual meetings with the research outreach and extension staff.

The OFCOR programs at Lumle and Pakhribas Agricultural Centers have been supported primarily by their own on-station research programs, which in the case of Pakhribas has been expanded to meet the growing needs of their OFCOR program. In 1984/85 Pakhribas Agricultural Center created the socio-economics section and has just recently re-established the horticultural section which had previously been dropped. Plans are also being made for adding a soil scientist and soil laboratory to further reinforce the backstopping of the OFCOR program. The on-station research programs at both Lumle and Pakhribas have altered their research priorities, breeding methods and screening procedures as a result of information coming in from the on-farm research programs. Regular meetings between field staff and station-based staff for planning and review have facilitated an effective two-way flow of information.

Other programs have been closely associated with the national experiment stations as a source of inputs and trials, such as the

Table 38: Linkages Between On-Station Research and On-Farm Research

OFCOR Site	On-Station Research	On-Farm Research	Source of Inputs
PAS	PAS/NRIP	Outreach	PAS in collaboration with extension staff
CSP	Agronomy Division and Commodity Programs	Cropping Patterns Verification Trials FFT Minikits	Agronomy Agronomy Agronomy Agronomy
FSRDD	Agric. Dept. Livestock Dept. Forestry	Cropping Systems Livestock Pasture/Fodder Soil Fertility Agro-Forestry	Department of Agric. Livestock Dept. Livestock Dept. Livestock/Forestry Agric. Dept./Forestry
PAC	PAC Center	Outreach Cropping Systems Livestock Horticulture Pasture/Fodder Soil Fertility Agro-Forestry	Under KHARDEP/PAC Agronomy Section Livestock Section Horticulture Section Livestock/Agronomy Agronomy/Livestock Agronomy/Forestry Under PAC Center
LAC	LAC Center	Cropping systems Livestock Pasture/Fodder Horticulture and Income Generation Soil Fertility Agro-Forestry	Agronomy Section Livestock Section Livestock/Forestry Horticulture Section Agronomy/Livestock Agronomy/Forestry Under LAC Center

minikits and farmer field trials from the commodity programs. OFCOR staff in all programs have been kept up to date in experiment station research activities through the national system of working group meetings and seminars.

Budgetary Systems, Funding Trends and OFCOR Share

For all programs, budget allocations have shown an increasing trend which indicates the importance that is being attached to applied and adaptive research in farmers' fields. The trend at Pakhribas Agricultural Center, which separates its research budget into on-farm and on-station programs, indicates that a greater proportion of funds are now being spent on OFCOR (approximately 60% in 1987/88) than in the past. The Parwanipur Agricultural Station outreach

program accounts for 44% of the station's total budget. Similarly, the minikit program of the National Rice Improvement Program accounts for 23% of their total operating budget.

In the case study programs that receive their funding through the regular government budget, problems with late disbursements have been seen to hamper OFCOR activities. Many OFCOR program activities do not necessarily coincide with the government's fiscal year and provisions need to be made to allow for activities which extend beyond the annual budget period. In addition, many OFCOR programs encounter or identify problems in the field during the implementation of their programs which need investigation and evaluation. Presently, these problems must wait until they can be included in the next year's budget. Flexibility in budgeting systems, such as at Pakhribas and Lumle needs to be examined if OFCOR programs are to be effective in longer-term activities.

Of particular importance is the fact that all of the OFCOR programs are receiving support from donor-funded projects (Table 39). This brings into question the need to examine problems of the continuity and sustainability of OFCOR programs which derive a large share of their support from donor funds.

Table 39: Donor Support for Case Study Programs

Case Study	Source of Support
PAS: NRIP	Supported by USAID under the Integrated Cereals Project and Agricultural Research Extension Project.
PAS: Outreach	Supported by the World Bank/IDA funded Agricultural Extension and Research Project
CSP	Supported substantially by the USAID Integrated Cereals Project.
FSRDD	Partially supported by the USAID funded Agricultural Research and Extension Project
LAC	Totally supported by the British Overseas Development Administration
PAC	Supported by the British Overseas Development Administration directly and indirectly through the Koshi Hills Area Rural Development Project.

CHAPTER FOUR

ASSESSMENT OF THE PERFORMANCE OF THE CASE STUDIES IN KEY OFCOR FUNCTIONS

INTRODUCTION

This chapter examines the performance of the case study programs in the seven functions the ISNAR study considers to be central to the majority of OFCOR programs. These functions are described below:

Function 1: support a problem-solving approach within research which is fundamentally oriented to farmers as the primary clients of research.

Function 2: contribute to the application of an interdisciplinary systems perspective within research.

Function 3: characterize major farming systems and client groups, using agro-ecological and socio-economic criteria, in order to diagnose priority production problems and identify key opportunities for research, with the objective of improving the productivity and/or stability of those systems.

Function 4: adapt existing technologies and/or contribute to the development of alternative technologies for targeted groups of farmers sharing common production problems by conducting experiments under farmers' conditions.

Function 5: promote farmer participation in research as collaborators, experimenters, testers, evaluators, and disseminators of alternative technologies.

Function 6: provide feedback to the research priority-setting, planning and programming process so that experiment station and on-farm research are integrated into a coherent program focused on farmers' needs.

Function 7: promote collaboration with extension and development agencies in order to improve efficiency in the processes of technology generation and diffusion.

The intention of this section is to review the relative importance of these functions in the five OFCOR programs studied and analyze the organizational and managerial factors which have facilitated or impeded the performance of the functions. A similar assessment has been developed in all nine country case studies.

The assessments presented reflect the analysis of the study team based on information gathered from primary data collected across the case studies; from interviews with farmers, field assistants, district agronomists, and on-station senior and junior research staff; as well as the experience and knowledge of the case study research team who prepared this report.

Under the review of each function, the five case study programs are compared in terms of the relative importance of the function within each program as well as the organization and management factors influencing the performance of the function. When relevant, lessons are drawn from the experiences of the programs and suggestions for improving functional performance are given.

One limitation of this comparative analysis is that it is highly subjective because in many cases it is difficult to make objective measurements from which to form conclusions. The authors fully recognize the risks and limitations involved in this methodology. In some cases, the individual case study assessments may not be in agreement with assessments that might be made by other research personnel within the country, because of their differences in experience, knowledge and outlook.

The other difficulty in the comparative analysis arises from differences in objectives, priorities and methodologies found within the different case study programs. Not all programs perform all seven functions, and some programs perform some functions better than others. However, the strength of OFCOR programs in Nepal lies in the complementary nature of the individual programs, having been developed out of the strengths, weaknesses and limitations of other programs.

ASSESSMENT OF FUNCTIONAL PERFORMANCE

Supporting a Problem-Solving Client-Oriented Approach Within Research

The first OFCOR function is support for a problem-solving approach that is fundamentally oriented to farmers as the primary clients of research. The basic feature of this assessment is to examine how well the case study programs have promoted a client-oriented philosophy in their research programs to ensure that these programs are targeted to solving identified problems in their targeted client groups.

The relative importance of the function across the case study programs is given in Table 40. The ratings have been assigned on a scale of 1 to 5, where 1 indicates that the performance of the function was not important, and 5 indicates that its performance was critically important. A detailed comparison of the performance of the function in the individual programs is presented in Chart 15.

The rice evaluation program in the National Rice Improvement Program at Parwanipur has not emphasized solving problems identified through farm-level analysis. This is mainly because of the use of exotic rice varieties which have primarily come from the international agricultural research centers. However, there is evidence that the program is trying to become more problem oriented. Increasing

CHART 15: Case Study Comparison of the Support of a Problem Solving Approach Based on a Systems Perspective within Research which is Fundamentally Oriented to Farmers as the Primary Clients of Research.

	PAS	CSP	FSRDD	LAC	PAC
1. General assessment of performance:	OFR at PAS is based on rice and rice-based production systems. The major focus of research is on identifying problems in irrigated and rainfed rice environments. PAS has modified its research over time to support a problem-solving approach which includes more farmers within the different agro-ecological regions.	OFR was based on the cropping system approach. Surveys were used at CS sites to identify existing cropping patterns and farmer problems. CS research trials were modified to meet the needs of farmers and the production potential of the sites. Recommendations derived from trials were the basis for a national crop production program.	FSRDD is continuing to build upon the work of the CSP but has expanded activities to include an FSR approach. Interdisciplinary researchers using the "combined trek" methodology identify farmer problems in the field and develop appropriate trials with input from farmers. Work has been concentrated in the hill regions.	OFR is based on an inter-disciplinary thrust approach. At three sites, LAC has begun an FSR program which involves on-station staff in OFR work. LAC first developed the "joint trek" concept to insure an interdisciplinary approach in identifying farmer problems and coordinating a research program which would help solve these problems.	OFR activities at PAC are based on the concept of production systems. "Joint treks" have been used to deal with specific problems identified by field staff in the research command area. Initial work done in the Local and Northern Target areas has given PAC considerable experience in the region.
2. Indicators of performance:	More than 30 rice varieties have been released. New varieties are now evaluated for their performance in the hills and Tarai as well as under irrigated and rainfed conditions. Verification of new material in farmer fields has made the PAS/NRIP program more effective in developing appropriate varieties.	CSP not only introduced new technology into the major cropping systems but also tried to verify technology appropriate for resource-poor farmers. CSP through the minikit program made seeds of new varieties available to many farmers. CSP technology has been adopted on more than 100,000 ha in a national production program.	Using socio-economic surveys and combined treks, FSRDD has been able to identify location-specific constraints within their FSR sites. Trials are now being conducted to find solutions for these problems.	LAC has made sufficient progress in solving farmers' problems and has recommended varieties and management practices for most of the major crops in their area. Staff at LAC have been able to put research knowledge into practice within their target area.	PAC has established an effective "outreach research" program in four districts. The OFR staff have been able to "fine tune" the selection of cropping patterns and management practices by being stationed in the research sites and working closely with local farmers.
3. Organization and management:	At a national perspective, PAS is working on more location-specific research. Problems are being encountered with feedback through level of hierarchy.	Farmers' problems at the site level were well assessed by CSP staff. Close cooperation with the commodity programs and disciplinary divisions via the ICP made inputs available to develop suitable recommendations.	Limited staff within FSRDD has made the organization weak in their ability to solve farmers' problems. Plans are underway to strengthen the linkage with other disciplines in OFR implementation.	The present structure at LAC has research staff doing both OSR and OFR. As both programs have expanded, management problems have developed, but links with sites are good. Time and staff constraints need to be worked out to maintain a strong program.	PAC has promoted a viable problem-solving approach by using research staff from the Hill areas who have experience in hill agriculture as well as locally hired farmers for field assistants. PAC's small size and regional mandate have helped it be more effective.
4. Salient lessons:	The approach at PAS is effective in identifying national-level problems. However, limited supervision and monitoring have limited the effectiveness of identifying micro-level problems.	Problems of resource-rich farmers have been well identified but the CSR approach was limited in its effectiveness. Too much emphasis was placed on the "pushing out" of new technologies without necessary feedback.	FSRDD's organizational structure has led to the reliance on other disciplines. Reliance on others for cooperation without any incentives creates difficulties in coordination.	The small size of LAC's program and its regional mandate have allowed LAC to develop a very effective OFR program. Involvement of the site coordinators in the planning meetings has been very effective.	PAC's strong organizational set-up from the center to the field has led to effective program implementation. Farmers have learned to prioritize their problems and have gained confidence in managing research trials.
5. Suggestions:	OFR on a national scale needs to be well communicated and maintained to meet its objectives. The outreach program if well defined could begin to help identify farmers' problems at the micro-level.	CSP technology needs to be directed more towards the needs of the resource-poor farmers.	Incentives need to be provided to encourage the participation of other disciplines. Experience gained from the CSP needs to be incorporated into the FSRDD as well as by other disciplines.	LAC should build upon the linkages being developed with the Hill Food Projects T&V system to better integrate their activities in the area.	The socio-economic section at PAC needs to have greater input into the OFR program to make the problem-solving approach more effective.

Table 40: Relative Importance in the Case Study Programs of Supporting a Problem-Solving, Client-Oriented Approach in Research

Function 1:	PAS NRIP - OUTREACH		CSP	FSRDD	LAC	PAC
	1	4	4	2	5	5

Scale: 1 = Not important.
2 = Moderately important.
3 = Important.
4 = Very important.
5 = Critically important.

emphasis is being placed on the development of the domestic breeding program using exotic and locally obtained materials. Information that has come back to the National Rice Improvement Program from its national farmer field trials and minikit programs has indicated that the majority of farmers in Nepal have not benefited from the technologies developed to date. Changes were implemented in the farmer field trial program in the early '80s which reflected the growing awareness of the need to develop appropriate rice varieties for the different agro-ecological areas prominent in the country. Farmer field trials are now being developed for both rainfed and irrigated conditions as well as for the Hills and the Tarai.

The lack of a direct linkage between the rice breeders who design the OFCOR trials and the extension/outside research staff who implement the trials in the farmers' fields has been partly responsible for the lack of information regarding the priority problems of the farmers. Present performance, while still considered weak, is expected to improve as National Rice Improvement Program staff become more involved in the Parwanipur outreach program and as more products of their own breeding program are brought out.

The Parwanipur Agricultural Station outreach program, which was designed as a production-oriented service program, has given much more importance to this function and has implemented a program that brings extension staff and a station-based outreach research staff together in the field to diagnose problems which limit farmers' production. The program has been modeled on the Cropping Systems Program using survey techniques to identify major farmer problems and constraints. Problems identified in the field are then directly communicated by the outreach research staff to the on-station research staff at Parwanipur for the development of solutions. Regular review mechanisms involving field staff and station-based research staff have been established to continually update the program and evaluate its performance.

The Farming Systems Research and Development Division has just begun operation and it is still too early to make an adequate assessment of its performance in this function. Although it adopted many of

the methodologies of the Cropping Systems Program as it was expanded to an enlarged farming systems research approach, it has not been able to obtain the necessary staff to implement the program at a level that can begin to address this function. The strength of the Farming Systems Research and Development Division lies in its close relationship with the Socio-Economic Research and Extension Division and their joint planning and implementation of the samuhik bhraman methodology. When FSRDD has a full complement of staff from all the disciplines required to implement a farming systems research approach within the complex Hill farming systems, and when it receives technical support from the other disciplines and commodity programs, this methodology will be a valuable tool for prioritizing and identifying farmers' problems and planning its OFCOR program. Without the support of the commodity programs and disciplinary divisions, the linkages between the other national programs will remain weak and inefficient.

Lumle and Pakhribas Agricultural Centers, working under more favorable institutional conditions and with regional mandates, have, on the other hand, both developed very strong, problem-solving approaches focusing on farmers' needs. Both programs have developed investigative applied and adaptive research programs which have evolved out of their original training and extension programs. The present on-station research programs are geared to supporting their OFCOR research staff in the field by seeking solutions to problems which have been identified through the samuhik bhraman and the thrust-based working groups. Field staff are highly motivated and well trained and have built up not only the confidence of the farmers in their target area, but have also been able to establish a high degree of collaboration with their clientele groups. Both Pakhribas and Lumle have attempted to develop a range of recommendations for all crop, horticulture and livestock varieties within their target areas.

Applying of an Interdisciplinary Systems Perspective

The assessment of this function refers to the extent to which the case study programs have contributed to the application of an interdisciplinary systems perspective within research. Chart 16 presents the comparison of the performance of this function across the cases. Table 41 below presents the assessment of the relative importance of the function in the individual case study programs.

Table 41: Relative Importance of an Interdisciplinary Systems Perspective in the Case Study Programs

Function 2:	PAS NRIP - OUTREACH	CSP	FSRDD	LAC	PAC
	1 3	4	3	5	4

Scale: 1 = Not important.
2 = Moderately important.
3 = Important.
4 = Very important.
5 = Critically important.

The degree to which the case study programs have identified the need for an interdisciplinary approach is almost universal. Only in the case of the programs at Parwanipur Agricultural Station (both the National Rice Improvement Program and the Outreach Program) has the lack of a socio-economic input been identified. Although the outreach staff have adopted the Cropping Systems Program methodology and do implement socio-economic surveys, the surveys are designed and analyzed by agronomists, which may limit their effectiveness. For the biological scientists there is a good degree of interdisciplinary work, both formal through established teams and informal through personal relationships the research staff maintain with their home-based staff and staff at other agricultural stations.

The Cropping Systems Program is especially noteworthy for introducing socio-economists into the agricultural research system in Nepal. Through the interdisciplinary activities of the program, which included socio-economic staff in the same office with agronomists, many joint reports were prepared and distributed throughout the national agricultural research system. The quality and amount of information contained in the reports was fundamental to natural scientists recognition of the potential contribution of socio-economists to research.

The situation at the Farming Systems Research and Development Division is again one of a lack of permanent posts and reliance on other programs and offices to provide staff on temporary assignment and deputation. This has not allowed the Farming Systems Research and Development Division to develop the core staff required to carry out an interdisciplinary-based approach. The Farming Systems Research and Development Division has maintained very close contacts with the Socio-Economic Research and Extension Division, and the two divisions collaborate on many activities related to the implementation of OFCOR activities at the farming systems research sites. This is best typified by the joint planning and implementation of the samuhik bhramans.

Both Lumle and Pakhribas have accorded this function very high importance. Both centers have well established multidisciplinary sections. Interdisciplinary work at Lumle has been especially significant in the farming systems research sites that were designed to create greater collaboration between the research programs in individual sections. Using the socio-economic section to coordinate all farming systems research activities in the field, all sections participate in all aspects of OFCOR activities from problem identification to trial implementation and evaluation of results.

The samuhik bhraman, which has been institutionalized and occurs regularly twice a year, was first developed at Lumle to encourage an interdisciplinary approach, and it involves all senior research staff from the different sections. The samuhik bhraman is used at Pakhribas in the same manner as at Lumle, but the methodology has not yet been regularized. Pakhribas, which has a much larger target area, has used this methodology to address specific problems that have been identified in the field and which require an interdisciplinary approach for solutions. For both Pakhribas Agricultural Center and Lumle, it has proven very effective.

CHART 16: Case Study Comparison of the Application of an Interdisciplinary Perspective in Research

	PAS	CSP	FSRDD	LAC	PAC
1. General assessment of performance	PAS/NRIP research team is composed of natural scientists working in an interdisciplinary and single-commodity mode. Socio-economists have not been included in the research team.	Interdisciplinary team approach used but limited to CSP agronomists and socio-economists. Strong links with commodity programs and other disciplines.	FSRDD uses an FS-based interdisciplinary approach in implementing combined treks; however, center staff and site-level staff are discipline oriented.	LAC has an interdisciplinary team at the center for both OSR and OFR. Thrust groups are responsible for developing farming system programs at the sites.	The individual sections at PAC work together in an interdisciplinary mode through the research working groups. OFR field staff are discipline oriented.
2. Indicators of Performance:	Research being conducted in farmers' fields for rice crop management is linked to all key disciplines including soil science and irrigation engineering.	The CSP center team traveled together and interacted well with the CSP site staff and participating farmers. Data were analyzed jointly between agronomists and economists and many reports were jointly published.	FSRDD along with SERED jointly organizes and coordinates the combined treks which include staff from other disciplines. Experience with the combined treks indicates that it is an excellent method of generating interdisciplinary discussion.	LAC first developed the concept of the combined trek selecting sites for their FSR program. It has since been institutionalized. Their success with the concept in bringing together different disciplines has been transferred to the other major OFR programs.	PAC has not institutionalized the combined trek but has used it effectively to deal with identified problem areas in their OFR program. PAC is now moving into an FSR program and is using the interdisciplinary concept to bring sections together into working groups.
3. Organization and management	OSR and OFR research staff all operate under the NRIP. Research staff are encouraged to participate in group monitoring and on-farm activities via a government mandate that they spend 40% of their time in on-farm work. Group monitoring by research staff is performed occasionally.	The CSP was located in the agronomy division with socio-economists and agronomists working together as a team. The ICP helped to facilitate good linkages with other disciplines and commodity programs through expatriates working in these programs.	OFR trials under FSRDD are developed with assistance from research staff in other disciplines who participate in the combined treks. Difficulties in getting the required participation has limited the effectiveness of the FSRDD farming systems site programs.	The interdisciplinary approach used in implementing OFR at LAC has mainly been a result of the leadership of LAC and the existence of the various disciplines. Regular group meetings and decisions on OFR activities and decisions on OFR activities have resulted in a successful OFR program.	The OFR program has been well defined within the outreach research command areas but limited to the agronomy section. Assistance from other PAC sections is not effected as a result of the movement to a working group approach which involves the other disciplines.
4. Salient lessons:	Because various disciplines involved in OFR have permanent status and the roles and responsibilities are well defined, there is no need to look to other institutions for cooperation to coordinate an interdisciplinary group approach.	The interdisciplinary approach was used effectively to demonstrate technology that was technically feasible, economically viable and socially acceptable.	The interdisciplinary approach has been used to identify farmer problems and priorities for which the national OFR trials have been designed and implemented at the FSR sites.	LAC's use of interdisciplinary thrust groups has been very effective in facilitating intersectoral cooperation in developing appropriate technologies for its clients.	The interdisciplinary approach to problem identification, prioritization and trial design for the OFR program has been effectively implemented through the use of the combined treks and working groups.
5. Suggestions:	Encourage an interdisciplinary group approach which includes socio-economists.	Encourage an interdisciplinary group approach which includes research staff from other disciplines.	Locate staff from other disciplines within the FSRDD to make the DFR program more effective and permanent.	To sustain the implementation of OFR within the target areas in an interdisciplinary perspective, there needs to be an organizational arrangement at the field level which has full support of the existing disciplines.	The socio-economic section at PAC needs to be more fully involved with the on-going outreach research program.

Other management mechanisms used by the Pakhribas and Lumle Agricultural Centers, such as the monthly technical meetings and annual work-planning meetings, are also noteworthy in that they have brought the staff together not only for the development of OFCOR trials but in the review and evaluation process as well. All sections must submit proposals for trials and surveys to the technical meetings for joint discussion and approval. This procedure has been important in developing a strong interdisciplinary approach. Pakhribas and Lumle have also developed the concept of working groups organized around a specific problem, such as soil fertility or income generation. These working groups have been successful in seeking immediate solutions to key problems identified in the field.

Characterizing Major Farming Systems and Client Groups

The function relates to the way in which the case study programs have characterized the major farming systems and client groups, using agro-ecological and socio-economic criteria, in order to diagnose priority production problems as well as to identify key opportunities for research. The comparison of the performance of the case studies for this function is given in Chart 17. The assessment of the relative inportance of the function in the individual programs is shown in Table 42.

Table 42: Relative Importance of Characterizing Major Farming Systems and Client Groups in the Case Study Programs

Function 3:	PAS NRIP - OUTREACH		CSR	FSRDD	LAC	PAC
	2	3	3	4	4	4

Scale: 1 = Not important.
2 = Moderately important.
3 = Important.
4 = Very important.
5 = Critically important.

All case studies have used, as a minimum, well-defined agro-ecological criteria for identifying major farming systems within the country. In addition, several programs have used socio-economic criteria to further define client groups within these farming systems. The Cropping Systems Program, which was the first OFCOR program within the country (initiated in 1977), introduced the methodology developed by the International Rice Research Institute's Cropping Systems Network, which included various steps in the identification and development of cropping systems sites. This methodology was subsequently adopted and adapted by the Farming Systems Research and Development Division, the Parwanipur Agricultural Station Outreach Program and by the Pakhribas Agricultural Center.

CHART 17: Case Study Comparison of the Characterization of Major Farming Systems and Client Groups

	PAS	CSP	FSRDD	LAC	PAC
1. General assessment of performance:	NRIP has continually reviewed the rice growing environments in Nepal and uncovered the poor performance of new varieties in rainfed and resource-poor conditions. With the increasing demand from local farmers for better rainfed rice varieties, a new breeding program using local and improved genotypes has been implemented.	The CSP socio-economic group used formal and informal surveys to characterize the major farming systems at the CS sites and to identify research opportunities in crop production systems. The problems identified by the farmers were closely related to the work being done by the CSP research staff.	FSRDD and SERED have used formal and informal survey techniques along with the combined trek to characterize the major farming systems at the FSR sites and to identify research opportunities. The problems and priorities identified by farmers correspond closely to the work being done by the FSR research staff.	FSR sites at LAC have been chosen to reflect the various agro-ecological conditions in their target area. Socio-economic surveys have helped to characterize major existing farming systems and client groups. These data have been a key component in the OFR decision-making process which involves multidisciplinary meetings at the center.	Because of the wide variation in client groups within the PAC research command area the OFR program has concentrated on identifying the major cropping patterns through formal and informal socio-economic surveys. PAC has adopted recommendation domains as the basic framework for all on-farm trials.
2. Indicators of performance:	Five distinct agro-ecological criteria have been defined by PAS/NRIP: 1) irrigated early rice; 2) irrigated normal season rice; 3) rainfed normal season rice; 4) rainfed upland rice; 5) rainfed and upland hill rice.	CSP identified major cropping systems for both irrigated lowland and rainfed upland conditions at the CS sites. For example: at the Lele site, rice-wheat for irrigated lowland and maize+soyabean - mustard for upland rainfed were two major cropping patterns used to diagnose priority production problems.	Farming systems indicators identified to date have been limited to cropping patterns within the different agro-ecological environments. Indicators for the other major components of the farming systems, such as livestock, forestry and pasture, have not been well identified by the FSRDD research staff.	The interdisciplinary thrust approach has been used to solve identified problems. Thrust groups developed include: 1) fodder thrust; 2) soil fertility; and 3) income generation through horticultural crops.	Crop recommendation domains are described by a combination of altitude, land type and cropping patterns. PAC has also developed a working group approach to involve center-based sections in an interdisciplinary problem-solving approach for the OFR program.
3. Organization and management:	In addition to group monitoring for characterizing farming systems and client groups, national seminars that include district and regional extension staff and other on-farm research staff provide feedback to the national-level OFR program but are weak.	The socio-economic group and the agronomists worked closely together to characterize the major cropping systems and client groups using information collected at the CS sites.	Information from FSR sites so far has been analyzed mainly by agronomists to identify farming systems and client groups. SERED has helped on occasion. To characterize other components of the FS sites, FSRDD has had to rely on other disciplines and SERED.	LAC first developed the combined trek to help identify and characterize the major client groups and farming systems in its target area. Addition of thrust approach has helped develop strong interdisciplinary approach.	OSR and OFR committee meetings using information from socio-economic surveys and feedback from OFR field staff have been used to identify cropping patterns and recommendation domains.
4. Salient lessons:	Site-level information and inputs from extension staff if well collected and analyzed could be used to characterize major farming systems and client groups for a national perspective.	Distinction between irrigated lowland and rainfed upland reflects the major characteristics of cropping systems which must be considered by research staff to prioritize research problems.	To prioritize production and research problems in a farming systems perspective, the involvement of all disciplines is critical to the success of the OFR program.	New techniques which have been developed such as the combined trek and the thrust approach have been very successfully in helping to identify key farming systems and client groups.	Working groups and the use of the combined trek, as at LAC, have been the key mechanisms to characterize the major farming systems and client groups successfully.
5. Suggestions:	Information collected from the trials sites should be analyzed promptly and reported back to the extension staff. This would encourage their participation in the program give them incentives.		FSRDD needs sufficient staff from all the required disciplines to help make it better able to identify and characterize the different farming systems and client groups.	The thrust approach needs to be continually focussed on problems identified at the farm level.	PAC's socio-economic section needs to include more economic and social input into its recommendation domain classifications.

One major weakness of this approach has been the separate activities of the agronomists and socio-economists. Cropping systems sites were initially selected by agronomists who used agronomic criteria to select sites representative of the major agro-ecological areas in the country. Once the sites had been selected, the socio-economists conducted surveys (key informant, baseline and other rapid rural appraisal methods) to identify the socio-economic characteristics of farmers at that particular site, including the major cropping patterns, which formed the basis for the Cropping Systems Program OFCOR program. The joint participation of the agronomists and socio-economists in site selection and description may have resulted in sites which were more representative of the actual conditions.

The Cropping Systems Program's OFCOR activities were mostly limited to resource-rich areas, i.e., irrigated lowland conditions. Sites may have been selected by agronomists which were more suitable to the technology "already on the shelf" rather than to identifying problems which needed the generation of new technologies. Consequently, the Cropping Systems Program work in the Hills, where the majority of the farmers operate in resource-poor conditions and the agricultural input supply infrastructure is very weak, was not as successful as it was at the sites in the Tarai.

For the National Rice Improvement Program, the use of agro-ecological conditions to characterize farming systems and client groups has been evolving over time as more appropriate technologies are being developed. Rice varieties are now being developed for five different agro-ecological conditions and more attention is being focused on developing varieties for the low-input conditions which are characteristic of the subsistence farmers.

Lumle Agricultural Center is the only case study where the characterization of farming systems and site selection has involved all multidisciplinary sections and is based on agro-ecological and socio-economic criteria. The initial development of the Samuhik Bhraman was for this express purpose. Lumle is now in the process of further defining their farming systems research sites by introducing the concept of recommendation domains (classifying research areas using a number of agro-ecological and socio-economic variables, e.g., altitude, aspect, slope, soil type, rainfall patterns, ethnic groups, outside income, etc.). Given the large degree of heterogeneity that exists within the Hills both in terms of agro-ecological and socio-economic conditions, the identification of well-defined "client groups" is very difficult. The recommendation domain concept is proving to be more applicable.

The Pakhribas Agricultural Center has also used the Cropping Systems Program methodology to select and classify their OFCOR sites. However, Pakhribas views its sites as constantly being in a state of redefinition and refinement. It also introduced the recommendation domain concept and uses both the information and experience of its district agronomists based in the field as well as input from the socio-economic section, which collects information through surveys and analysis of aerial photographs of the entire research command area. The use of the recommendation domain methodology has helped to realign the research priorities of the OFCOR program.

Adapting Existing Technologies and/or Developing of Alternative Technologies

This function relates to how the case study programs have adapted technology and/or contributed to the development of alternative technologies by conducting experiments under farmers' conditions. The cross-program comparison is presented in Chart 18. Table 43 gives the assessment of the relative importance of this function across the five programs.

Table 43: Relative Importance in the Case Study Programs of Adapting Technologies and/or Developing Alternative Technologies

Function 4:	PAS NRIP -	PAS OUTREACH	CSP	FSRDD	LAC	PAC
	3	4	4	3	4	4

Note: 1 = Not important.
2 = Moderately important.
3 = Important.
4 = Very important.
5 = Critically important.

Adapting existing technologies and developing alternative technologies by conducting experiments under farmers' conditions have been the basic objectives for all the case study programs. The use of farmer managed/implemented trials in the pre-production or verification stage has been adopted by all programs. Researcher-managed trials have been limited to the multilocational testing program under the National Rice Improvement Program, which is designed to verify experiment station research results and to demonstrate to farmers the advantages of improved varieties and agricultural practices. Farmer field trials are now increasingly being used by regional agricultural farms and stations (especially Lumle and Pakhribas Agricultural Centers) to identify new technologies appropriate to their specific areas. Less emphasis is being placed on the national evaluation of technology.

The Cropping Systems Program was thought by many experiment station researchers as more of a vehicle for the field verification of existing technology and less as a methodology that would indicate areas where alternative technologies needed to be developed. This gave the Cropping Systems Program more of an adaptive research function and limited its effectiveness to farmers who had conditions suitable for the existing technology. The Cropping Systems Program was successful in making a number of recommendations for specified cropping patterns that were used in a national production program which now covers more than 100,000 ha. However, later on in the Cropping Systems Program it was realized that the existing technologies were inappropriate for many of the Hill conditions and the need for applied research was emphasized. This was taken as one of the summary objectives of the new Farming Systems Research and Development Division.

CHART 18: Case Study Comparison of the Adaptation of Existing Technologies and/or the Contribution to the Development of Alternative Technologies

	PAS	CSP	FSRDD	LAC	PAC
1. General assessment of performance:	PAS's OFR program is designed to compare alternative technologies with the existing technologies adopted by farmers. Adaptive research is being directed at the major agro-ecological areas. The OFR program allows farmers to test the new technologies against their own. Acceptable new technology is disseminated primarily by trial farmers to other farmers in the area.	CSP trials were designed on the basis of the existing predominant cropping patterns at the CS sites. Most of the trials were on-farm adaptive research trials. Trials were designed to test the production potential of the new technologies from the commodity programs.	FSRDD is continuing the work of the CSP at most of the same sites. Additional activities of the FSRDD program include livestock, forage and fodder, and horticultural trials.	LAC has tested and adapted much of the existing technology appropriate for its target area. It has also varified alternative technologies to recommend in the recently established FSR sites through OFR, which includes a variety of disciplines.	The research outreach program conducts OFR trials to address problems that have been identified by farmers. Farmers from selected cropping patterns test new technology using diamond trials which give the farmers a better idea about the performance of the new technology under their own conditions.
2. Indicators of performance:	Based on the national OFR program, PAC has recommended more than 20 new rice varieties for irrigated lowland environments. For rainfed conditions, PAC is developing alternative technologies by introducing local genes into its breeding program.	CSP has recommended cropping patterns suitable for the Terai and to some extent for the Hills. In the Terai, CSP-based technology has been implemented in more than 100,000 ha through a national production program.	The present program of the FSRDD includes the utilization of existing technologies as well as the verification of alternative technology which may better solve problems identified at the FSR sites.	LAC has produced a number of recommendations for farmers in their target area, including cropping patterns, crop varieties and modified local technologies.	PAC has used existing cropping patterns as a base to verify new component technology. It has been working on increasing crop intensity by verifying alternative patterns.
3. Organization and management:	PAS has introduced an outreach program to better understand problems of local farmers and increase feedback. FFIs have been modified based on feedback from this and other programs. Greater collaboration with extension staff has made the program more effective.	CSP used a center-based team to manage site-based teams at the cropping system sites. Site coordinators reported to the CSP coordinators (Head of Agronomy) but did not actively participate in the planning and programming processes done from the center.	FSRDD has become an independent division, but to fulfill its objectives it must include staff from other disciplines, especially at the testing level in the field.	The joint responsibility of research staff in both OSR and OFR had contributed significantly to the development of alternative technologies for the target areas under its regional mandate.	PAC's OFR program is based in the agronomy division and works in a small regional area. Working groups have been instituted to develop a more comprehensive farming systems approach.
4. Salient lessons:	Recorded and reported results of adoption of existing technology are very limited. Most of the cases reported show that alternative technologies have performed better.	After several years of OFR, CSP was able to make relevant recommendations for suitable cropping patterns in the Terai.	The farming systems approach has been demonstrated to be more effective in solving complex problems in the more marginal Hill areas than the cropping systems approach.	LAC has been able, through regional testing, to identify minor limitations to the existing technology and to modify the technology as per the priorities of the farmers to make it adoptable.	The OFR program at PAC has generated considerable information and data on farmer practices and varieties, which have given them valuable insight into improving the production systems.
5. Suggestions:	For verifying the performance of existing technology and alternative technologies, reports should also focus on alternative technologies which have not performed well.	Farmers' priorities should be equally considered in the process of developing alternative technologies.	FSRDD should utilize the available CS-based technology while at the same time adding the additional disciplines required to carry out FSR.	The potential contribution of OFR in the development of alternative technologies should be utilized at both the regional and site level.	Socio-economic analysis to confirm the recommendation of existing technologies needs to be strengthened. This would help provide new direction to the OFR program.

While the Farming Systems Research and Development Division recognizes the importance of this function, its performance in this area has been only moderately good. One of the major reasons has been Farming Systems Research and Development Division's inability to effectively implement its program due to a lack of staff. Additional difficulties have been experienced in finding suitable technologies (especially for livestock and fodder/pasture) to test in the farming systems research sites. Technical support from the commodity programs and disciplines has yet to be developed.

Both Lumle and Pakhribas Agricultural Centers have developed strong applied and adaptive research programs to serve their target areas. They also recognized early on that there was a lack of appropriate technologies for the Hill areas and quickly moved into applied research to identify the technologies (either improved or local) that were most appropriate (technically and economically) to recommend to their clientele groups. Many of their recommendations now consist of combinations of local and improved technologies. Technology recommendations which have been based on local varieties and/or local husbandry practices have not always been accepted, however, by the national extension program for recommendation in other areas. This has caused some conflict between the center research staff and local government extension staff. As a result, it is not uncommon to find a number of different recommendations for the same crop in the research command areas of both Lumle and Pakhribas.

Promoting Farmer Collaboration in Research

The function refers to the role of the case studies in promoting farmer participation in research as collaborators, experimenters, testers and evaluators of alternative technologies. The comparison of the case studies performance of this function is presented in Chart 19. The importance of this function in the individual programs is given in Table 44.

Table 44: Relative Importance of Farmer's Collaboration in Research in the Case Study Programs

Function 5:	PAS NRIP - OUTREACH		CSP	FSRDD	LAC	PAC
	3	4	5	4	5	5

Scale: 1 = Not important.
2 = Moderately important.
3 = Important.
4 = Very important.
5 = Critically important.

All case study programs have involved farmers, in varying degrees, in the participation of research activities.

The primary source of farmer involvement has come out of the use of the samuhik bhraman by the Farming Systems Research and Development Division, Lumle Agricultural Center and Pakhribas Agricultural Center. Farmers, along with an interdisciplinary research team, jointly identify problems and constraints in the field. Discussions involving the farmers and research staff evolve into joint agreement on research priorities and the initial designing of trials. After the trials have been designed, they are once again reviewed with the farmers and then implemented by the collaborating farmers in the area.

The use of different trial methodologies has involved farmers in varying degrees as collaborators, experimenters, evaluators and disseminators. Minikits, which have been used by all the programs, have been designed for farmers to evaluate new varieties (many of which are pre-release varieties) and to disseminate them locally if farmers like them. Farmer field trials which have also been used by all the case study programs, have used farmers mainly for collaboration in the testing process as they tend to be mostly researcher managed.

The pre-production verification trials, introduced by the Cropping Systems Program, have given farmers a chance to test new technology packages against their own varieties and practices. These trials are also being used by the Farming Systems Research and Development Division. Lumle and Pakhribas Agricultural Centers have taken these trials one step further by changing their design to a four-way testing methodology (diamond design) that gives the farmer more input into the trial -- he can test his own local variety with his own practice and with the improved practices.

This modified methodology has been well received by the participating farmers in the Lumle and Pakhribas target areas as it gives the farmers a much wider choice and it "de-packages" the technology, which often makes it more appropriate to the conditions of the farmers. Pakhribas and Lumle have also gone beyond the standard collection of basic trial measurements and have put an increased emphasis on farmers' opinions on the performance of the trial. This information has resulted in a better assessment of performance of individual trials and has helped avoid making inappropriate recommendations.

Pakhribas Agricultural Center has recently initiated a program that identifies local farmers who are known to be informal experimenters. In this program, Pakhribas gives the identified farmer new material (either varieties or improved practices) to test in his own way. Then center staff monitor the farmers regularly to learn what they do with the material and to see how they modify it to make it suitable to their needs. Recognition of these farmer researchers and their regular incorporation into the OFCOR program will help make better use of scarce research resources and will contribute to the development of technologies appropriate to farmers in these areas.

Providing Feedback to Research Priority Setting, Planning and Programing

This function refers to the role of the OFCOR programs in providing feedback to the research priority-setting, planning and programing

CHART 19: Case Study Comparison of the Promotion of Farmer Collaboration in Research.

	PAS	CSP	FSRDD	LAC	PAC
1. General assessment of performance:	PAS promotes farmers' participation in its national-level OFR tirals, utilizing the in testing, evaluation and dissemination.	At the CS sites, farmers were actively involved. Through socio-economic surveys, input from farmers was used to identify, develop and test new technologies.	FSRDD has followed the CSP approach at its sites.	LAC's OFR program is keyed directly into the use of local farmers for testing and evaluating new technology. Farmers are involved right from the beginning in site selection.	Farmers as a source of knowledge and collaboration is highly respected at PAC. Farmer experimentors are being identified for a special program to use them as testers.
2. Indicators of performance:	Many farmers participating in the minikit program saved seeds and distributed them to other farmers. Some farmers who had collaborated on FFTs were later found using the same methodology for testing new varieties in their own small plots by themselves.	The experience gained by many of the participating farmers in the CSP is still being used by the farmers to evaluate and test new technologies even though CSP is no longer functioning.	So far, indicators of farmers' perticipation in the testing and ecaluation of new technologies have not been well documented.	OFR trails are handled primarily by farmers and supervised by research and field staff. The OFR trials use farmers from many different socio-economic and agro-ecological groups.	Most of PAC's OFR trials are farmer managed under the guidance and supervision of the district agronomist and field assistants. Farmers gained confidence in their role as collaborators and experimenters.
3. Organization and management:	Farmers are used to conduct minikits in their own fields using their own practices. They are guided by extension staff.	CSP trial farmers were selec-selected from the CS sites on fixed criteria which helped to identify farmers who were interested and capable of implementing OFR trials. Field staff, based at the sites, led to increased contact with farmers.	FSRDD is applying the same methodology as was used in the CSP. The use of the samuhik bhramans brings farmers actively into the research process.	OFR trials are designed and based on field verification by farmers. Farmers' feedback and participation as researchers is considered the key component in LAC's program. Local farmers hired as field assistants help in selecting trial participants.	PAC uses local farmers hired as field assistants to select participating OFR trial farmers. Agronomists, based at the OFR sites, guide and supervise the collaborating farmers.
4. Salient lessons:	The use of FFTs has helped research staff learn more about farmers' problems in different agro-ecological areas. Minikits, if used as a research tool, could provide more information.	Exposure and involvement in the CSP activities gave many farmers confidence in their own work which now includes some experimenting on their own.	Given the complexity of the farming systems of the resource-poor farmers in the hills, the promotion of their participation as collaborators will depend very much on their willingness and interest.	Frequent monitoring by the research staff from LAC has helped promote the participation of local farmers as researchers and evaluators. Farmer assessment of a new technology is a key factor.	Having research staff based in the field working with locally recruited field assistants has helped promote a better exchange between researchers and farmers. Farmers' impressions on trials have been a key input.
5. Suggestions:	1. To make the minikits more effective, the monitoring and supervision of the participant farmers is most important. 2. The initial objective of promoting farmer participation through minikits and FFTS as testors and evaluators of technologies for the remote Hill areas needs to be well communicated to all involved in their implementation.	CSP could have promoted greater farmer participation in the OFR trials as experimenters by allowing them to modifying the OFR trials. These modifications could have been an important source for the design of future trials and sites.	In the resource-poor environment of the hills, the development of new technology will be very dependent on the participation of local farmers. The selection of farmers will be critical as trials can be very risky and prone to failure.	Given the range of variation in the agro-ecological conditions within the LAC target area, the participation of farmers in the research process will be more cost-effective and should be promoted in all testing sites.	The use of local farmers in the experimenting and evaluation process should help to make better use of research resources. The recent attempt to identify experimenting farmers and their involvement in the research process will make research more effective and less expensive.

processes so that experiment station and on-farm research are integrated into a coherent program focused on farmers' needs. The cross-study comparison is presented in Chart 20. Table 45 presents the individual assessment of the relative importance of the feedback function in each program.

Table 45: Relative Importance of Providing Feedback to Research Research Priority Setting, Planning, and Programming in the Case Study Programs

Function 6:	PAS NRIP - OUTREACH		CSP	FSRDD	LAC	PAC
	3	4	5	3	5	5

Scale: 1 = Not important.
2 = Moderately important.
3 = Important.
4 = Very important.
5 = Critically important.

In all case study programs, information from OFCOR activities has been regularly communicated back to the major experiment station research programs (commodity programs and disciplinary divisions). Since the development of the national commodity programs in 1972 and the their implementation of on-farm research (initially farmer field trials and later minikits), annual crop workshops have been organized for summer and winter crops. Participants at these workshops have included staff from all case study programs in addition to representatives from the Ministry of Agriculture, Department of Agriculture (extension), donors, and other development projects. During the course of these workshops, the case study programs have reported on their research and jointly discussed future on-farm trials using inputs provided by the commodity programs and disciplinary divisions.

Since the reorganization of the national research system and the creation of the National Agricultural Research and Services Center, these national workshops have been redefined as annual working group meetings for each of the specific crops as well as for farming systems research. Technical discussions are now more in-depth, resulting in better-defined research planning and programing.

The Cropping Systems Program, which was located within the agronomy division had particularly close linkages with the commodity programs and disciplinary divisions through the Integrated Cereals Project. The Cereals Project provided a number of expatriate advisors for the three major commodity programs (wheat, maize and rice) in addition to a cropping systems agronomist and socio-economist for the Cropping Systems Program. These advisors helped develop strong linkages among the programs by involving their counterparts in the activities of the Cropping Systems Program. One example of this feedback linkage was the identification by the Cropping Systems

CHART 20: Case Study Comparison of the Provision of Feedback to Research Priority Setting, Planning and Programming.

	PAS	CSP	FSRDD	LAC	PAC
1. General assessment of performance:	Through OFR, PAS researchers gained insight into the problems of the different rice growing environments. This influenced the researchers to modify the priorities of the breeding program to develop suitable varieties for rainfed upland conditions.	CSP, being implemented through the agronomy division, maintained direct contact with the commodity programs and other disciplinary divisions for the flow of the new technology and for feedback into the research priority-setting process.	FSRDD was created to conduct OFR in coordination with other disciplines under NARSC. However, FSRDD has not been able to identify suitable technologies from the other disciplines to incorporate in its OFRS programs.	Through OFR, LAC research staff have gained a greater understanding of farmers' problems and constraints. This has helped develop a more coherent program focused on farmers' needs.	OFR programs have had a major impact on the research priorities of the on-station research program. Through the working committee in the agronomy section, OFR and OSR staff have programmed the work in coordination. Staff from the center visit the field sites on a regular basis.
2. Indicators of performance:	Work at PAS/NRIP has evolved from using exotic materials obtained from IARCs which were often not the solution the Nepalese farmers were looking for. With the development of their own breeding program using exotic and local material, PAS/NRIP has been able to develop varieties more appropriate to the identified needs of the farmers.	The CSP monitoring group, based at the center, often visited CSP sites with staff from the commodity programs. Such visit provided direct interaction with farmers and promoted a better understanding between on-station staff and OFR staff. This encouraged the changing of research priorities at the major commodity programs.	The samuhik brahman has been the major source of feedback and interaction between OFR staff and on-station staff. Limited participation from		
3. Organization and management:	Organization and management of feedback from outlying research and extension staff has been indirect for the NRIP program and direct for the outreach program where OSR staff have been involved in field trials with the research outreach staff.	Feedback from the CSP was directly the result of its relationship with the commodity programs and disciplinary divisions. The role of expatriates in the ICP was also a key factor in the organization of the linkages between the programs.	FSRDD must cooperate with the other programs and disciplines and is dependent upon their participation in the FSRDD OFR program for it to be effective. To date, this cooperation has yet to be developed fully.	The direct role played by senior research staff at LAC in both on- and off-station research has been vital to the program's success. The use of field staff coordinated through the socio-economics section has helped to promote cooperation between all sections.	OFR staff are situated within the agronomy section which facilitates a rapid flow of information and integration of research activities. The use of the samuhik bhraman and working groups on a problem-oriented basis has brought sections together to solve problems jointly in the field.
4. Salient Lessons:	Group monitoring of OFR activities by OSR and OFR research has provided feedback to the setting of research priorities and the development of appropriate technologies but needs to be strengthened.	Good communication between the CSP research staff and the staff of the commodity programs and disciplinary divisions was a key to the successful implementation of the CSP.	FSRDD's lack of permanent staff and its dependence on other programs for support in its OFR activities has made it weak in terms of applying a farming systems approach.	The burden of the research staff to conduct on- and off-station trials has been increasing as LAC's programs have expanded within the area. Important organization decisions will have to be made as the workload, both on and off the station increases.	The use of joint meetings involving staff from all sections for planning, programming and justification of OFR trials has been important in the development of an integrated and coherent programs.
5. Suggestions:	The frequency of group monitory needs to be increased not only in the Tarai areas but also in the remote and isolated Hill regions where variability is greater.	Frequent visits by research staff to farmers' fields has been demonstrated to be very important in the success of the CSP.	Other disciplines required by the FSRDD to implement an effective FSR program should be established within the FSRDD. Only in this way can effective feedback be developed for a coherent program.	A separate OFR research staff needs to be developed to take over the responsibility of the field programs. As the program expands, this will ensure that the necessary feedback will ensure that the necessary feedback will be obtained to coordinate OSR activities.	PAC's move to a more FSR-oriented program needs to be encouraged and developed. The present working groups should become the major focus for developing a coherent and coordinated program involving all sections.

Program research staff of the need for a short maturing maize variety to fit into a cropping pattern that had been identified as suitable for growing an early maize crop in the hills. The expatriate maize agronomist and his counterpart maize breeder worked closely with the Cropping Systems Program staff and succeeded in identifying and developing a variety which fit the requirements.

However, there are a number of examples where the feedback from the Cropping Systems Program trials and their resultant recommendations (particularly related to breeding priorities and fertilizer recommendations) were not well received by the commodity programs and disciplinary divisions. Much of this was the result of the inferior status accorded the Cropping Systems Program within the national research system and the perception of many station-based research staff that the primary responsibility of to program was to help disseminate research recommendations developed at the experiment stations to farmers through land verification and demonstration processes.

The institutionalization of the Cropping Systems Program into the Farming Systems Research and Development Division has not yet raised its status within the national agricultural research system. Until the FSRDD is able to develop a permanent core staff of researchers, it will be unable to implement an effective OFCOR program to generate the kind of information that the national programs could use to set priorities.

The interaction of the Parwanipur Agricultural Station outreach staff and its on-station research staff through the T&V project has resulted in the development of special research programs to find solutions to problems (such as rice gall, midge and appropriate seeding rates) that have been identified in the research outreach area. This system of feedback has helped develop a coherent OFCOR program focused on the particular needs of the farmers in the research outreach area.

Until recently, Lumle and Pakhribas Agricultural Centers, though active participants in the national workshops and working group meetings, did not view the changing or altering of national research priorities as a major objective of their OFCOR program. While they did take advantage of their linkages with the national programs as a major source of inputs into their research programs, their primary interest was in establishing their own priorities for their mandate areas within their own research establishments. Consequently they have developed effective mechanisms (technical meetings, trial protocols, working groups/thrusts and the samuhik bhramans) for incorporating feedback from the OFCOR programs into their own station-based research program. With their new role as regional research centers within the national system, they are now collaborating with the national programs in setting research priorities and planning research that will be beneficial in their research areas. Pakhribas Agricultural Center, for instance, has recently cooperated with the national maize program to develop a new white maize variety. Lumle is participating in the screening of rice, wheat and maize breeding lines for cold tolerance and hail resistance.

Promoting Collaboration with Extension and Development Agencies

This OFCOR function refers to the role of the case study programs in promoting collaboration with extension and development agencies in order to improve the efficiency of the technology generation and diffusion processes. The comparison of performance across the case studies is presented in Chart 21. The assessment of the relative importance of this function in the individual programs is shown in Table 46.

Table 46: Relative Importance of Promoting Collaboration with Extension and Development Agencies in the Case Study Programs

Function 7:	PAS NRIP - OUTREACH		CSP	FSRDD	LAC	PAC
	2	5	4	2	4	3

Scale: 1 = Not important.
2 = Moderately important.
3 = Important.
4 = Very important.
5 = Critically important.

The performance of this function by the two programs at Parwanipur Agricultural Station showed a marked contrast. While the National Rice Improvement Program felt that this was a moderately important function, the Outreach Program felt that it was of critical importance to the success of the program. In retrospect, the National Rice Improvement Program has had heavy involvement in the national extension program because the extension staff are mostly responsible for implementing and supervising the farmer field trials and minikit programs throughout the country. However, this has been much more of a one-way linkage, with information and trial material being "sent out" to the extension offices. Much confusion has resulted, especially over the role of the minikit, whether it is an "extension" or a "research" tool. In many cases, the extension staff do not understand the purpose of the trials nor have they been given the rationale behind the trials. Trial instruction sheets are often in English. The information that is returned to the National Rice Improvement Program by the extension staff is mostly oriented toward the technical performance of the varieties or agricultural practices being tested. Little information emanating from the farmer participants or from the extension staff themselves on the utility or appropriateness of the technologies is fed back to the National Rice Improvement Program.

Extension staff often complain that after implementing the trials and sending back the data, they never receive any feedback on the trials they have implemented. As a result, they have not seen any benefit from doing the trials. This has resulted in a technology generation process which is almost devoid of a human input. Most of the recommendations produced by the National Rice Improvement

CHART 21: Case Study Comparison of the Promotion of Collaboration with Extension and Development Agencies

	PAS	CSP	FSRDD	LAC	PAC
1. General assessment of performance:	At PAS, minikits are implemented in farmers' fields by extension staff who assist in filling out feedback cards. These results are analyzed by the PAS research staff, presented at the national working group meetings and disseminated back through the extension system.	CSP worked closely with the extension service when the program mived into the production phase. Training was provided by the CSP staff to extension agents in implementing PPVTs. Prior to this phase, CSP was relatively independent from the extension programs.	FSRDD is just beginning to develop recommendations as a result of its field activities and so far there has been little cooperation with the extension programs.	Within its target areas, LAC has its own extension section. It has started, however, to cooperate with the local extension programs, especially through the T&V system being operated in the HFP project.	PAC has its own extension section which takes care of its own NTA and LTA. In the research command area, the district agronomist are located in the ADO offices but the relationship between the PAC staff and the ADO staff has not been formalized. At the moment, the relations are informal and personal.
2. Indicators of performance:	Extension staff are invited to the national working groups to present their experiences with the minikit program and to learn the results of the trials. Recommendations are developed for dissemination by the extension staff.	Extension staff in other parts of the country conducted PPVTs to verify the CSP recommendations prior to the startup of the national production program. CSP provided training and backstopping for the program.	Participation of extension staff in FSRDD activities is very limited. Attempts are being made to involve local extension staff in the FSR site areas in the samuhik bhramans but formal links have yet to be established.	LAC is actively working with the national extension program in the training of extension staff. DLAR is recognized as a regional training center for the western Hill Region. It is in the process of integrating its own extension staff into the national system.	PAC links with the national extension service are still primarily informal. They do, however, provide training courses to extension staff in the eastern Hill Region as well as to staff from the national programs.
3. Organization and management:	OFR in the outreach program is conducted through the T&V system, in collaboration with the district extension programs. Extension staff assist in the selection of farmers and in the supervision of the OFR trials. They also provide feedback to PAS staff.	CSP worked closely with the district agricultural offices in the CS sites. Though there was no direct involvement of extension staff in the CS sites, awareness of the CS activities was promoted by site tours and field days.	Extension has not played an important role in the organization and management of the FSRDD program. This has been recognized as a problem and consideration as to how to get greater involvement is under investigation.	Within LAC, the extension and research programs are highly coordinated. LAC's extension section is responsible for implementing many of the section's OFR trials. LAC is now promoting greater cooperation with the national extension program.	PAC's OFR trial areas are organized around the agricultural service centers of the ADO offices. This has exposed many extension staff to the FAC OFR program and may be the basis for greater collaboration in the future.
4. Salient lessons:	The utilization of extension staff in the OFR program has not only increased the information flow from the field but has been a cost-effective way of implementing the program.	CSP's development of successful recommendations and the training programs for extension staff resulted in the successful collaboration with extension programs during the final phase of the CSP.	Even though the final results of FSRDD's OFR activities are to be disseminated through the national extension system, their involvement in the generation and verification of technology has been limited.	LAC's successful OFR program has been built on an existing strong relationship between research and extension. The two programs have fully supported each other in the generation and dissemination of new technologies.	Many of the local extension staff have been cooperating with the PAC district agronomists in their OFR programs. These personal relationships need to be formalized to ensure an effective linkage.
5. Suggestions:	Training should be given to extension staff in OFC methodology to promote their active participation in the technology verification and dissemination process with farmers.	Extension staff which have been trained by CSP to implement PPVTs should be encouraged to conduct OFR activities in remote areas where research activities are limited. Technical support could be made available through the national research programs.	Extension staff working in the hill areas should be involved in the FSRDD programs at the FSR sites. These extension staff can be a valuable source of information which could be used to make the OFR programs more relevant to the area and more cost effective.	LAC needs to strengthen its linkage with the national extension service. Both programs could benefit by the exchange of knowledge and experiences which would result from greater collaboration.	PAC needs to formalize the relations of its field staff with the national extension service. Building on the many informal and personal relationships that have already been established would make both programs stronger.

Program (and other commodity programs as well) are high-input and high-cost technologies which are often inappropriate for many parts of the country where fertilizer and pesticides are not available or, if available, are not affordable to the majority of farmers.

On the extension side, extension staff working in the field feel that they have little to offer to their farmer clientele in the way of appropriate new technology. This has put extension staff into a very difficult situation. Both the research scientists and extension staff have tended to blame one another. As this has been a critical area of weakness, many projects have attempted to address the research-extension linkage issue.

The Parwanipur Agricultural Station outreach program is an example of an attempt to address this linkage problem. This program is being directly supported by a training and visit (T&V) project which brings the outreach research staff into a joint working relationship with the extension program. Using subject-matter specialists as a link between the two programs, bi-monthly and semi-annual meetings bring the staff together with senior research staff at Parwanipur to review the problems and constraints identified in the field and to develop solutions.

During the phase of the Cropping Systems Program when recommendations were generated (which lasted for four years out of the total seven-year project), there was little involvement of the national extension program staff. The program did not develop significant linkages with the extension program until it entered the final phase, which was the transfer of recommendations into a national production program. The transfer of research results into farmer "language" was not recognized until late in the project. Information and research generated by the Cropping Systems Program significantly changed many of the original recommendations developed by the individual crop commodity programs, although these programs were not always receptive to the proposed changes.

Surveys by the socio-economists within the Cropping Systems Program found that many farmers lacked information about the new technologies and recommendations. In the process of disseminating and verifying their new technology and prior to launching production programs, the Cropping Systems staff conducted training programs for the extension staff in the implementation and evaluation of the pre-production verification trials. This was highly successful and is now a major activity in most of the district extension offices throughout the country.

The Farming Systems Research and Development Division has yet to involve the local extension programs at its farming systems research sites in active collaboration despite the experience gained from the Cropping Systems Program. This has been recognized as a major weakness but formal attempts to actively encourage the participation of extension staff in the farming systems research sites has yet to take place. Plans are being made to include more local extension staff in the samuhik bhramans.

Lumle and Pakhribas Agricultural Centers have developed strong extension programs linked very closely to their research programs. This stems from the training and extension function for which the

centers were created. As both centers are now being recognized increasingly by the National Agricultural Research and Services Center as playing a major role in their regions, they have made moves to integrate their extension programs with the national extension system.

Lumle has recently entered into an agreement with the Hill Food Project which is operating a training and visit (T&V) system. Lumle provides research support similar to the outreach program at Parwanipur Agricultural Station and in addition is playing a major role in training government extension staff throughout the area. OFCOR staff at Pakhribas Agricultural Center are located in the district extension office and assist in monthly extension staff meetings and training. However, the relationship is informal and is dependent upon the individuals involved. Many of the district agronomists work with government extension staff near their trial sites and involve them in activities which include field days and farmer tours through the trial areas. Pakhribas is making moves to institutionalize this relationship with defined roles and responsibilities.

Summary

Table 47 presents a summary of the overall importance of seven functions in the case studies. As indicated in the beginning of this section, not all case study programs consider the performance of all the functions as important, and indeed, some programs consider certain functions to be more important than others. The organization and management factors that have played a key determining role in the performance of the functions is different for each of the case study programs. This is not to be perceived as a point which one can evaluate in a positive or negative way. For Nepal, the key factor has been the complementarity of the programs and their willingness to cooperate with each other in sharing the ideas and methodologies that have served to strengthen the individual programs. All programs have made significant contributions to the development of on-farm client-oriented research programs which are becoming more sensitive to the needs of the many different client groups in Nepal.

There is, however, one note of caution for research managers not familiar with the programs that have been described in this report. On the surface, it would appear that the privately funded programs at Lumle and Pakhribas Agricultural Centers, which have been able to implement all the OFCOR functions more fully, are the programs which should be emulated by the other programs in Nepal or even in other parts of the world. However, the directors and staff of these centers will be the first to indicate that their present programs have been developed at a financial and manpower cost that could not readily be duplicated in many national agricultural research systems. Moreover, they have regional rather than national mandates. This issue is now being addressed in Nepal. Technically, these two programs have already been fully integrated into the National Agricultural Research and Services Center. However, the ultimate objective at some point in time will be the integration of the management and administration of these programs as well. How this will affect their performance of the seven OFCOR functions remains to be seen.

Table 47: Summary of the Importance Attributed to the Seven Functions in the Case Studies

	PAS NRIP	PAS OUTREACH	CSP	FSRDD	LAC	PAC
Supporting a problem-solving client-oriented approach to research	1	4	4	2	5	5
Applying an interdisciplinary systems perspective	1	3	4	3	5	4
Characterizing major farming systems and client groups	2	3	4	4	4	4
Adapting existing technologies or developing alternative technologies	3	4	4	3	4	4
Promoting farmer collaboration in research	3	4	5	4	5	5
Providing feedback to research priority-setting, planning, and programming	3	4	5	3	5	5
Promoting collaboration with extension and development agencies	2	5	4	2	4	3

Scale: 1 = Not important.
2 = Moderately important.
3 = Important.
4 = Very important.
5 = Critically important.

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

LESSONS LEARNED

Introduction

Nepal has had quite a long history in implementing on-farm client-oriented research programs. During the 10 years that have passed since the Cropping Systems Program first introduced the concept of cropping systems and on-farm client-oriented research, OFCOR in Nepal has evolved in several different ways. However, as this study has pointed out, the different organization and management techniques and styles of the OFCOR programs in Nepal have been seen as complementing one another rather than being competitive. These different programs have led to the development of some very interesting methodologies such as the the samuhik bhraman, or "combined trek".

Perhaps the major lesson that can be learned from this study is that there is no one best way to organize and manage an OFCOR program. Each program, at least in Nepal, has its own unique set of conditions and has developed the most appropriate form of program to cope with these differing circumstances. The range varies from large national programs such as the Farming Systems Research and Development Division, Parwanipur Agricultural Station/National Rice Improvement Program and the earlier Cropping Systems Program to the smaller, more regionally focused programs at Pakhribas Agricultural Center, Lumle Agricultural Center and Parwanipur Agricultural Stations' outreach program. Also, the need for more robust OFCOR programs is equally evident as research moves from the relatively easy conditions found in the Tarai toward finding solutions for the problems of the more marginal and complex areas of the Hills. Aside from those listed above, the following additional lessons have been derived from the analysis of the five case study programs.

Internal Organization of On-Farm Research

On-farm programs which have developed very hierarchical models, such as the Parwanipur Agricultural Station/National Rice Improvement Program, have found it difficult to get research scientists, who make decisions on research programs, in touch with farm-level conditions and problems. With little or no contact with the staff or farmers, researchers in these programs have not been able to understand the constraints of the farmers who are intended to be their clients. The involvement of socio-economists in OFCOR programs has been seen to be very beneficial in the identification of clients or client domains, as is the case at Pakhribas and Lumle Agricultural Centers.

Development and Management of Human Resources

The development of a well-trained, experienced cadre of OFCOR specialists is difficult when staff are hired on a temporary basis. Programs have suffered from a high turnover of staff and a poor return on training in OFCOR methodology. This has particularly been a problem with the project-funded OFCOR programs. Now that OFCOR has demonstrated its utility, it should be given more permanent status by the government and donors.

Locally hired farmers used as field assistants both at Lumle and Pakhribas, and contact farmers in the Parwanipur Agricultural Station's Outreach Program have been very effective. Their knowledge of the local conditions has helped to select appropriate trial sites and collaborating farmers.

Methodologies Adopted to Implement OFCOR

The use of thrust groups at the regional centers (Pakhribas and Lumle) has been instrumental in developing strong interdisciplinary linkages which concentrate on seeking solutions to identified problems in the field.

Trial methodologies that have been modified to meet the needs of research clients have been more effective in encouraging the active participation and involvement of local farmers. The use of the modified pre-production verification trials by both Pakhribas and Lumle allows the participating farmers to "test" their own practices against those coming from the station-based programs. This active interest on the part of the participating farmers has added a new dimension -- the farmer's opinion -- to the information the OFCOR staff obtain from their trials. It also builds up the confidence of the farmers in their ability to be research partners.

Management of OFCOR

The use of regular planning and programming meetings to maintain cross-disciplinary links and links between on-station and on-farm research by both Pakhribas and Lumle has been very effective.

The use of sites has also been seen as an effective and efficient way of organizing and managing OFCOR activities. Sites have been chosen with great rigor to ensure that they are representative (agro-ecologically and in some cases socio-economically) of larger areas, which gives the intensive micro-level research much greater justification.

The use of established sites for on-farm research has also promoted a better flow of information between on-station and on-farm researchers and farmers. Using field staff based at the sites has allowed the Cropping Systems Program, Farming Systems Research and Development Division, Lumle Agricultural Center and Pakhribas Agricultural Center to develop a sustained interaction with farmers. Various mechanisms have been developed to build communication linkages between the sites and the station-based staff. These range from the direct involvement of the station staff in the combined treks to the use of regular meetings involving cross-disciplinary staff and the on-farm research staff.

As field staff have gained experience at the sites, they are now becoming more involved in the programing of site activities (for example at the Pakhribas and Lumle Centers rather than just reporting the performance of station-developed trials.

Organization and Management of Linkages and Information Flows

Annual national working group meetings, seminars and workshops have been a very useful method for exchanging ideas and information not only between staff from different OFCOR programs but also between station-based and farm-based scientists, donor-funded projects, and national, regional and district government staff.

The use of the combined trek has been very useful for linking on-station research with OFCOR, particularly in setting research priorities. It has also been an effective tool for getting station-based staff out to field-based programs at critical points in the research process. Although the combined treks have been used differently by the Farming Systems Research and Development Division, Pakhribas Agricultural Center and Lumle Agricultural Center with varying degrees of participation from station-based staff, the direct involvement of the director in the combined treks at Lumle proved to be particularly useful in motivating staff to participate.

Information collected by the Pakhribas Agricultural Center field staff, and to some extent the Lumle Agricultural Center research staff, from local farmers carrying out informal research has been used to help them develop appropriate technologies more quickly and economically. Pakhribas Agricultural Center's testing of a special program to utilize the research ability of these farmers should be monitored closely by the other programs.

Farmer involvement in the research priority-setting process has been facilitated by the use of the combined treks and has often led to the redefinition of problems. Both Pakhribas and Lumle have altered their research priorities and methodologies as a result of their better understanding of farmers' constraints through meetings with farmers in the farmers' own environment. Both of these programs have also actively tried to involve research staff from the national commodity programs in their treks in the hope that they too will better understand the research problems in the more marginal areas of the country.

Budgeting Systems

The need for flexibility in budgeting systems has been demonstrated in the ability of different programs to respond quickly to new problems (many of which are being identified as a result of the increased interaction of on-station and on-farm staff in the field) as well as to making commitments to longer-term research activities. Both Pakhribas and Lumle have a higher degree of flexibility in their budgets and more control in shifting funds rapidly from one area of research to another. Government-funded programs and the rigid budgeting policies under which they must operate have acted in many ways as a deterrent to their efficiency and effectiveness.

RECOMMENDATIONS FOR IMPROVING ON-FARM RESEARCH IN NEPAL

Introduction

The following recommendations have been developed out of the case study analysis of the five on-farm programs surveyed in Nepal, and they address problems that were identified in Chapters 3 and 4. Using the lessons that have been learned in contrasting and comparing the organization and management of these five programs has allowed the case study team to make specific recommendations for the individual on-farm research programs. The case study team endorses the need to make on-farm research in Nepal more robust and effective in solving the complex problems that the farmers of Nepal are facing today.

Need for Robust On-Farm Research Programs in Nepal

Because of the great variability in the topographical, biological and social-economic conditions within the country, it is strongly recommended that more emphasis be placed on the development of regionally focused on-farm client-oriented research programs. The effectiveness of the small regionally focused programs at Lumle and Pakhribas Agricultural Centers supports this concept. On-farm research programs, with a national focus, while being somewhat effective at the macro level, have not been able to develop the expertise required to deal with the micro-level site-specific problems that are so prevalent in the country.

The case study team suggests that regionally based on-farm research programs be developed at the following existing government farms/stations in the different agro-ecological regions:

1. In the Eastern Hills - Paripatle Farm and PAC
2. In the Eastern Tarai - Tarahara Station
3. In the Central Hills - Kavre Farm
4. In the Central Tarai - Janakpur/Hardinath Farm
5. In the Western Hills - Khairanitar Farm and LAC
6. In the Western Tarai - Bhairahawa Farm
7. In the Mid-Western Tarai - Nepalgunj Station
8. In the Mid-Western Hills - Surkhet Farm
9. In the Far-Western Hills - Doti Farm
10. In the Western Tarai - Tikapur Farm

Internal Organization of On-Farm Research Programs

Since the on-farm research program at Lumle Agricultural Center has been expanding rapidly in the past few years, especially with its commitment to the training and visit program of the Hill Food Project and the prospect of its being given a larger regional mandate, it is recommended that more attention needs to be given to the organizational structure of the present program. As the activities of the station-based research staff are increased to support the on-farm program, the station-based staff will find it more difficult to participate in both on-farm and on-station activities.

It is strongly recommended that the Parwanipur Agricultural Station/National Rice Improvement Program and Outreach Program

include a socio-economist on their staff. Survey work needs to be done to ensure that all potential clients within their command area are identified and receive the benefits of the new technologies being developed by the National Rice Improvement Program.

It is also recommended that the socio-economic section at Pakhribas Agricultural Center support the on-farm research program more actively to identify client groups and to monitor the development of effective and appropriate technologies. The experience of Lumle Agricultural Center and the Cropping Systems Program has shown that a strong socio-economic input into the on-farm program has been a key to their programs' success.

Development and Management of Human Resources

To make the program of the Farming Systems Research and Development Division effective in carrying out research in farming systems, it is recommended that the government take the necessary steps to ensure that FSRDD is made permanent and allocated staff to give it the necessary interdisciplinary expertise required to effectively carry out a farming systems approach.

The participation of station-based scientists from the major commodity programs and disciplinary divisions in the combined treks of the Farming Systems Research and Development Division (and to some extent the treks at Lumle and Pakhribas Agricultural Centers) has been limited by insufficient budgets for travel and per diems. It is, therefore, recommended that more use be made of researchers from the different farms and stations located around the country for treks at the regional level.

Methodologies to Implement On-Farm Research

It is strongly recommended that all on-farm research programs adopt the trial methodologies best suited to their target-area clients. Modification of trials, such as has been done by Pakhribas and Lumle Agricultural Centers for the pre-production verification trials first implemented by the Cropping Systems Program, has given their collaborating farmers more input, especially in evaluating their own practices against new technologies.

It is also recommended that all programs take more effective action in identifying farmer priorities when planning and evaluating trials. Examples from the case study programs have shown that there is often a difference of opinion between researchers and farmers as to what the research priorities should be.

Management of On-Farm Research

It is recommended that government extension agents be more directly involved in on-farm research programs. Experience at Parwanipur Agricultural Station in the training and visit system-based outreach program as well as in the Cropping Systems Program's use of extension staff in conducting pre-production verification trials outside the cropping systems sites has shown that with training in on-farm research methodology, extension staff can be used effectively and economically. The training of extension staff so

that they could effectively collaborate in technology verification and dissemination would help make the minikit program more effective as a research tool rather than merely as a technology extension methodology, its current use.

All case studies generated large amounts of data from their on-farm research programs; however, these data do not always find their way back to the field. Extension agents who conduct farmer field trials for the national programs have felt that this has reduced their importance in on-farm research to the status of mere data collectors for the scientists. The same applies for the site coordinators in the Farming Systems Research and Development Division and the earlier Cropping Systems Program. Therefore, it is recommended that data from all on-farm programs should be collected and returned to the field in a form which will be useful to the field staff and make them feel more apart of the on-farm research program.

Similarly, it is recommended that programs similar to Pakhribas Agricultural Center's information dissemination working group (which is looking at better ways of getting the results and recommendations from their on-farm research program to their clients and to other on-farm programs) be developed in the other case study programs. Information being fed back to research clients needs to be in a form they can readily use.

As on-farm research programs expand, more data will be collected. It is recommended that an "economics of information" concept be applied to all data proposed to be collected. Lumle Agricultural Centers' movement in this direction with the protocol for all trials are surveys is laudable and the other programs should consider implementing this concept. Data collection processes always need to keep the needs of the clients at the forefront.

To assist the research efforts of other on-farm programs in the country, it is recommended that the results of trials and technologies that have "failed" be reported and discussed in the national working group meetings and seminars with equal status as trials and technologies that have been successful stories. Sharing this information should make the research programs more efficient.

Organization and Management of Linkages and Information Flows

It is recommended that Pakhribas Agricultural Center's program to utilize local farmer experimenters as research collaborators be adopted by the other on-farm research programs. This recognition of the on-going informal research programs being conducted by local farmers within the programs' target areas would make the development of appropriate technologies more efficient.

To strengthen the linkages between the different on-farm research programs, it is recommended that in addition to the discussion of technical issues during the annual working group meetings and seminars, organizational and management issues should also be discussed. This would allow the different on-farm research programs to share their experiences in these areas.

Budgeting Systems

It is recommended that the government adopt budgeting procedures that would allow flexibility in the operation of the Farming Systems Research and Development Division and the Parwanipur Agricultural Station/National Rice Improvement Program and Research Outreach Program. If possible, a system similar to the "revolving fund" used by the Cropping Systems Program should be implemented within the Farming Systems Research and Development Division or the National Agricultural Research and Services Center. Without this flexibility, these programs will not be able to address the problems identified after budgets and programs are fixed in yearly plans.

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